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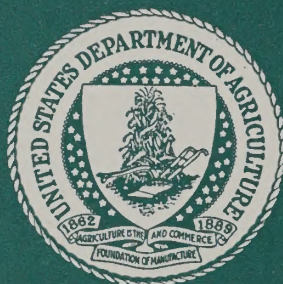


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UNITED STATES DEPARTMENT OF AGRICULTURE

REPORT OF
REAPPRAISAL OF DIRECT AGRICULTURAL BENEFITS
AND PROJECT IMPACTS

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FLORIDA PROJECT,

COLORADO —

COLORADO RIVER STORAGE PROJECT :#6

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Report Prepared by

USDA Field Advisory Committee and USDA Field Party

Salt Lake City, Utah - August 1959

ACKNOWLEDGMENTS

This report is based on available field data, published reports, and the combined judgement of agricultural technicians familiar with the project area, its agricultural problems and conditions. The Bureau of Reclamation furnished the USDA Field Party with preliminary reports, land classification maps and field sheets, information regarding water supply and acreage and location of lands to be included in the project. This information was used to augment field investigations such as soil surveys, economic surveys, engineering surveys, crop yield determinations, and irrigation water investigations made by members of the USDA Field Party, Soil Conservation Service and Agricultural Research Service.

The U.S. Forest Service, U.S. Bureau of Land Management, and others assisted in the watershed studies. The Forest Service also prepared Chapter III regarding the relationship of the project to national forest lands. Assistance from representatives of the Colorado State University, Colorado Cooperative Extension Service, Colorado Agricultural Experiment Station, State and County Agricultural Stabilization and Conservation Committees, U.S. Farmers Home Administration and others was valuable in preparing the report.

The contributions and assistance of these organizations in the preparation of this report are gratefully acknowledged.

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REPORT ON REAPPRAISAL OF DIRECT AGRICULTURAL BENEFITS AND PROJECT IMPACTS

FLORIDA PROJECT - COLORADO

SUMMARY

Authority

This report on the Florida participating project, Colorado River Storage Project has been prepared by the U.S. Department of Agriculture in response to the President's letters of March 19, 1954 to the Secretary of Agriculture and the Secretary of the Interior. In his letters, the President requested that a reappraisal of the direct agricultural benefits expected to be produced by the participating projects of the Colorado River Storage Project, be made by the Department of Agriculture in cooperation with the Department of the Interior. Following authorization of the Colorado River Storage Project by the Congress on April 11, 1956, an understanding was reached in July 1956 between the Secretary of Agriculture and Secretary of the Interior regarding conduct of a survey to reappraise direct agricultural benefits and to appraise project impacts. The Department of Agriculture survey was made under the authority of Section 6, Public Law 566, 83rd Congress, as amended, which authorizes the Department to cooperate with other federal, state, and local agencies to make investigations and surveys of the watersheds of rivers as a basis for the development of coordinated programs.

Purpose and Scope

The purpose of this report is to present information regarding the soil capabilities for irrigation, the present and future land use and production pattern, the costs associated with on-farm irrigation development, prospective size and type of farm, net returns with irrigation water, and the direct agricultural benefits for the Florida project. In addition to the agricultural phases, this report deals with the impacts of the project on the national forests and the relationship of watershed conditions to the project.

This report is based on the Florida project plan as outlined by the Bureau of Reclamation. It is confined to the proposed project facilities and to the project lands located on Florida Mesa and along the Florida River, which the Bureau of Reclamation plans to furnish with project irrigation water. The several analyses in the report reflect an estimate of the average management and application of practices anticipated as a result of project development.

The report also is intended to aid the Bureau of Reclamation in developing their Definite Plan Report, and to provide information bearing on the relationship of the project to the regular programs of the Department of Agriculture.

General Description

The Florida project is located in the San Juan Basin, southeastern La Plata County, Colorado. Elevation of the majority of project lands varies from 6,500 to 7,000 feet. The climate is semiarid. Average annual precipitation is about 17 inches. The average frost-free period is about 112 days.

With the exception of 1,000 acres of Indian land, and a small amount of state land, project lands are privately owned.

Agriculture is the basic industry of the project area. Livestock production is the predominant type of farming.

Proposed Project Development

The Florida project will provide irrigation water for 5,730 acres of nonirrigated land and supplemental irrigation water for 13,720 acres of presently irrigated land. The project plan proposes the construction of Lemon Dam and Reservoir on the Florida River. The reservoir will so regulate the river that late-season flows will be supplemented with stored water and thereby furnish an adequate irrigation water supply in most years. The reservoir will have a capacity of 40,300 acre-feet, including 39,000 acre-feet of active capacity for irrigation and 1,300 acre-feet of inactive capacity for sediment, fish and wildlife.

Evaluation of Expected Direct Agricultural Benefits

Evaluation Areas

For purposes of the analysis, project lands were grouped into evaluation areas. The soils, climate and water supply within each evaluation area reflect similar crop adaptations, productivity, land and irrigation development and production costs. Farm incomes and direct agricultural benefits were determined for each area and the project as a whole.

Evaluation area A includes 5,430 acres of presently irrigated lands and 1,590 acres of nonirrigated lands. These lands occur generally in a long strip extending north and south on Florida Mesa. Some evaluation area A lands are interspersed with lands of evaluation areas B and C. Slopes are generally three percent or less.

Evaluation area B includes 6,255 acres of presently irrigated lands and 3,565 acres of nonirrigated lands. These lands are located on Florida Mesa and have the same general characteristics of evaluation area A lands but have steeper slopes which range from 3 to 6 percent.

Evaluation area C includes 845 acres of presently irrigated lands and 575 acres of nonirrigated lands. These lands are interspersed with lands in evaluation areas A and B. They generally have steeper slopes and will require more careful management than areas A and B.

Evaluation area D includes 1,190 acres of land with various soil conditions, located in the river valley adjacent to the Florida River. These lands will receive a smaller increase in water supply than will those in evaluation areas A, B, and C.

Soils

Basic soils data were obtained from individual farm soil surveys previously made in the regular activities of the Soil Conservation Service. These surveys were augmented where additional information was needed. Soil surveys also were supplemented by detailed soil profile descriptions and analytical data on representative soils of the project. Copies of the Bureau of Reclamation land classification field sheets for the project were supplied to the Field Party.

The 7,020 acres in evaluation area A are in land capability class II. ^{1/} The 9,820 acres in evaluation area B are in capability class III. Ninety-three percent of the 1,420 acres in evaluation area C is capability class IV, and seven percent is capability class III. Evaluation area D comprises 1,190 acres of which 50 percent is in capability class IV, 25 percent in capability class III, and 25 percent in capability class II.

It is concluded that the 19,450 acres of lands designated as the Florida project are suitable for cultivation under irrigation.

Irrigation Supplies and Requirements

Several studies of irrigation requirements have been made in the general vicinity of the Florida project. These data, with additional information supplied by personnel familiar with the area, were used in determining irrigation water requirements. In the past, water-supply shortages have been in excess of 50 percent of requirements during years of low runoff.

Based on a weighted average net seasonal consumptive use of 1.28 acre-feet per acre, and an estimated weighted average farm irrigation efficiency of 53 percent, the average water requirement at the farm headgate will be 2.42 acre-feet per acre.

Based on a period comparable to 1928-1956, which was selected as the pre-project study period, the proposed facilities will deliver an average of 2.28 acre-feet of irrigation water at the farm headgate, thus meeting 94 percent of the average water requirements of the project lands. A 100 percent water supply will be available for project lands on an average of 7 out of 10 years.

^{1/} Land capability classes are in accordance with the national land capability classification, Soil Conservation Service Soils Memo No. 22, May 19, 1958.

Land and Irrigation Development

Development costs for project lands are estimated by evaluation areas on the basis of the level of management expected on the project and the physical requirements of the soils and site conditions. They are consistent with anticipated irrigation efficiencies and expected crop yields.

Estimated costs include clearing of nonirrigated lands, and leveling and establishment of farm irrigation systems on project lands. Minor seepage conditions can be corrected by proper irrigation practices, consequently no drainage costs are anticipated for project lands.

Estimated weighted average development costs per acre of irrigable land are: Evaluation area A, \$36.86 per acre; evaluation area B, \$39.37 per acre; evaluation area C, \$41.50 per acre; and evaluation area D, \$19.75 per acre.

Direct Agricultural Benefits and Potential Farm Income

The economic analysis of the proposed Florida irrigation project has two primary objectives: (1) An appraisal of direct agricultural benefits from project development, and (2) an appraisal of prospective farm incomes from representative sizes and types of farms considered most likely with the proposed irrigation development. Both of these analyses contribute to a general appraisal of the prospects for a successful, stable, irrigated agricultural economy. Farm incomes were estimated for five farm types, namely: Grade A dairy, range beef, feeder steer, farm flock of sheep, and cash crop.

Project lands are expected to be used largely for the production of feed and feed crops. Sale of livestock and livestock products likely will be the predominant sources of agricultural income to project farmers.

The residual approach is used to estimate direct agricultural benefits from irrigation water. The total value of crop and pasture production is allocated to the various factors of production, except water, in accordance with their projected market prices with the residual being credited to the project as a direct benefit.

Estimates of returns with the project in the analysis are based on weighted averages of anticipated farm types and sizes of 154 acres of evaluation area A lands, 156 acres of evaluation area B lands, 160 acres of evaluation area C lands and 111 acres of evaluation area D lands. The present annual equivalent value of direct benefits for these evaluation area lands are estimated at \$13.03, \$11.54, \$8.34, and \$1.72 per acre, respectively. The weighted average for the entire 19,450 acres is \$11.24 per acre, or about \$219,000 annually.

Development of the project will result in a more stable and profitable agricultural economy. For the farm sizes and types analyzed, adjusted annual farm incomes will vary from \$3,275 for a farm-flock sheep farm on evaluation area C lands to \$9,012 for a grade-A dairy farm on evaluation

area A lands. The general conclusion from this analysis is that the income prospects for these five types of farms analyzed, when fully developed, would be adequate to provide a satisfactory level of living and make some payments for costs of irrigation water.

Relationship of the Florida Project to National Forest Lands

The proposed Florida Project is adjacent to the San Juan National Forest. The Lemon Reservoir site is outside of the national forest; however, it lies within a ten square mile area bounded on three sides by national forest land. The forest boundary will be at a distance of one-quarter to two miles from the proposed reservoir. This proximity and geographical location of the reservoir give the Forest Service justifiable concern and interest regarding the character of use and anticipated development that will take place around the reservoir and on the intervening areas.

Construction and operation of the project will have significant effect upon national forest administration, management and protection. Intensified fire protection services will be needed during and after project installation. Relocation of the county road which now serves a portion of the national forest will be required.

It is anticipated that construction of the proposed reservoir will attract many visitors for camping, picnicking, boating and fishing. Therefore, recreational uses of the reservoir and adjacent land should be planned and facilities installed which will meet basic requirements for public health, safety, property protection, and prevent pollution of water supplies. Suitable lands, adjacent to the reservoir, should be reserved or acquired and be retained in public ownership for these purposes. The federal lands, lying within the ten square mile block bounded on three sides by national forest lands, should be withdrawn by the Department of the Interior and retained in unencumbered condition until further need for these lands for public recreation or other public purposes, can be determined. These lands and recreational facilities should be administered and maintained by a federal, state or local government agency to protect the public interest.

The concerned federal and state agencies may wish to consider a proposal to extend the present national forest boundary to accomplish these objectives.

Some of this increased recreational use will also extend to adjacent national forest lands requiring installation of minimum basic recreational facilities on national forest lands. Project installation and operation will have no adverse effect on Forest Service improvements or on future use of timber, grazing or wildlife resources on the national forest.

Relationship of Watershed Conditions to the Florida Project

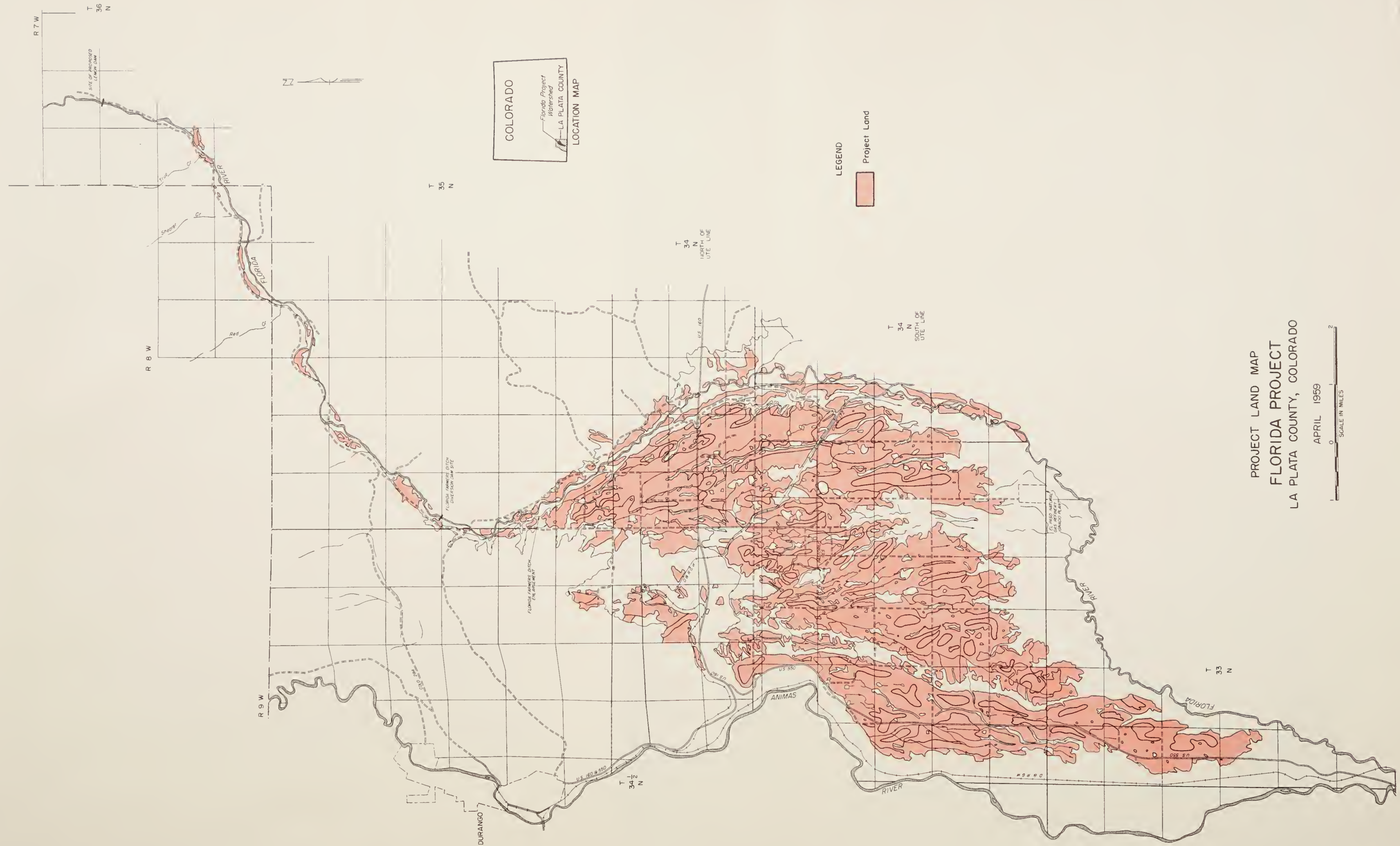
The watershed area of the Florida project comprises about 204 square miles. It consists of the Florida River drainage area plus that portion of Florida Mesa that drains into the Animas River. Watershed lands generally have a good vegetative cover and soil loss is normally slight. Watershed problems consist largely of: (1) The shale slide problem area on the east side and

the soil slide problem area on Burnt Timber Creek above the reservoir; and (2) the danger of flood and sediment damage from tributary side drainages to project facilities and to some lands located along the Florida River below the reservoir. Conditions of the watershed above the Lemon Reservoir site do not pose a flood hazard to the project.

Drainageways entering the Florida River below the reservoir will present some sedimentation and flood-water problems to irrigation canals and laterals. Project designs include structural measures where major drainageways intersect canal systems. Small local drainageways which empty into the canal can be handled by regular ditch operation and maintenance.

Sediment production can be reduced by the application of land treatment measures to watershed land. Improved watershed conditions will reduce ditch and canal operation and maintenance costs. The establishment of land treatment measures on problem areas will also reduce sediment carried by the stream and extend the useful life of the reservoir.

Needed watershed treatment can be accomplished under regular programs of federal land administering agencies and by private landowners with assistance such as would be furnished by federal and state agencies through Soil Conservation Districts and otherwise. The users of watershed land will receive sufficient benefits to justify their cooperation in this effort.



PROJECT LAND MAP
FLORIDA PROJECT
LA PLATA COUNTY, COLORADO

APRIL 1959

SCALE IN MILES
0 1 2

CHAPTER I

GENERAL INFORMATION

Organization

Pursuant to the U.S. Department of Agriculture Memorandum of Understanding between the Soil Conservation Service, Forest Service, and Agricultural Research Service, dated February 2, 1956, a USDA Field Advisory Committee, Colorado River Storage Project was established. The committee is composed of a representative from each of these agencies and a member representing the concerned state agricultural colleges. Principal duties of the committee are to maintain appropriate liaison and facilitate coordination of activities by the respective services and the state agricultural colleges in the survey. Field relationships with the Bureau of Reclamation and other interested state and federal agencies are also a responsibility of the committee.

A USDA Field Party, working under direction of the USDA Field Advisory Committee and operating within a plan of work dated August 22, 1956, is headquartered at Salt Lake City, Utah. The party is responsible for the collection and analysis of data and the preparation of this report.

Applicable data from previous investigations were utilized in the study.

Description of the Area

Location and Physical Features

The Florida project is located in the San Juan Basin, southeastern La Plata County, Colorado. Project lands lie in the Florida River valley and on the Florida Mesa. The northern end of the project is located approximately 12 miles northeast of the city of Durango, Colorado, and the southern tip of the project is approximately three miles north of the confluence of the Florida and Animas Rivers. Elevation of the majority of project lands varies from 6,500 to 7,000 feet.

Water for the project will be supplied from storage of surplus flows of the Florida River. This river has its source in the rugged San Juan Mountains northeast of Durango. Generally runoff water during the spring snow-melt period exceeds irrigation requirements.

Project lands are within the boundary of the La Plata Soil Conservation District organized March 18, 1947, and with the exception of approximately 1,000 acres of Indian land and a small amount of state land, are all privately owned. In the analysis, no distinction was made between the Indian lands and the private lands.

Soils of the project generally reflect the influences of the geology, semi-arid climate and sparse vegetative cover under which they have developed. Soils can roughly be divided into two groups:

Terrace Soils - These soils are located on the high terraces or mesas and are composed of aeolian materials from the sandstones and shales of the area. Organic matter content is low and profiles show moderate development in the subsoil and are calcareous in the lower horizons. These soils are usually uniform in general characteristics.

Valley Soils - Alluvium from the upper watershed deposited by the Florida River and local alluvium of shale and sandstone origin deposited by tributary streams, are the sources of material from which these soils have developed. The complex pattern of deposition from these two sources is reflected in the existing complex soil pattern.

Climate

The project area has a temperate semiarid climate satisfactory for irrigation farming. Prevailing winds are from the southwest. Temperatures and frost conditions limit the variety of crops grown to field crops such as small grain, corn for silage, pasture and alfalfa. Some beans, potatoes, apples, and early maturing vegetables are also produced.

Average annual precipitation for the project area varies from 15 to 19 inches. The average frost-free period is estimated to be 110-115 days. The last killing frost occurs about June 2 and the first killing frost about September 22.

History of Settlement

The first recorded history of the area was in 1541 when Coronado marched through from Mexico. In 1776 Father Escalante, in search of a route from Santa Fe to California, passed through the area. Most of the rivers were named by Father Escalante. The first miners came in 1860. The area was originally part of the Ute Indian Reservation and when mining developed, the U.S. Government purchased three million acres of land from the Indians. The townsite of Durango was included in this purchase. Farmers and ranchers followed the miners and the cattle industry grew to its peak during the period 1877-1887. The narrow gage railroad was built from Alamosa to Durango in 1881. Population of La Plata County has steadily increased since its origin in 1874.

Agricultural Development

Agriculture is the basic industry of the project area, with livestock raising the predominant type of farming. Farming operations in and near the project area have demonstrated that soils and climate are satisfactory for irrigated agriculture. Income is derived principally from the sale of livestock and livestock products. Irrigated lands are used primarily for the growing of feed grains and forage in connection with livestock enterprises. Adjoining national forest and public domain lands are used for spring, summer and fall grazing by cattle. Because of the fluctuating and frequently inadequate late-season water supply, the agricultural economy of the area has not been stable. Irrigated acreage fluctuates from year to year depending upon the anticipated supply of late-season irrigation water.

Most of the farms are dairy, beef, general and cash crop. Similar type farms are expected to prevail with the development of the project. Range rights on adjoining federal lands are fully allotted and no additional grazing permits will be available for new farms developed by the project.

Industrial Development

In addition to agriculture, a number of other industries help to support the local economy. Exploration and production of oil, natural gas, uranium and vanadium have flourished in the last few years. These industries are expected to become increasingly important to the economy of the area in the future. Because of this extensive activity, the population has increased considerably since 1950. This activity has not affected the farm population in the project area except for improved trading facilities and greater opportunity for outside employment.

Coal mining and lumbering are also important industries. During the summer and fall months the surrounding scenery, streams, lakes and forests, combined with fishing, hunting and sight-seeing are enjoyed by thousands of tourists.

General

Durango is the trade center of the area. It has an estimated 1959 population of 12,000. The principal means of shipping products to and from the project area is by truck. U.S. Highway No. 160 traverses the area east and west, and U.S. Highway No. 550 runs north and south connecting Durango with trading centers outside of the San Juan Basin. A narrow gage line of the Denver and Rio Grande Western Railroad connects Durango with standard gage connections at Alamosa, Colorado. Branch lines also connect Durango with Silverton and Farmington. Frontier Airlines provides passenger and commercial air freight service to Salt Lake City, Denver and Albuquerque. Electricity is provided within the project area by the La Plata Rural Electrification Administration Cooperative.

Proposed Development

The Florida project proposes the construction of Lemon Dam on the Florida River, enlargement and extension of the Florida Farmers Ditch, and construction of other distribution facilities. Lemon Reservoir, formed by the dam, would have a capacity of 40,300 acre-feet, including 39,000 acre-feet of activity capacity for irrigation and 1,300 acre-feet of inactive capacity for sediment, fish and wildlife. The reservoir would reduce flood flows along the river course and control the small quantities of silt in the river.

Storage and direct flow water would be available with the project for 19,450 acres of land, of which 13,720 acres are presently irrigated with a partial water supply and 5,730 acres are nonirrigated. In addition, approximately 1,710 acres of nonproject land will continue to receive their present water supplies.

With the proposed development, farming in the project area is expected to be similar to other areas in the San Juan River Basin of Colorado and New Mexico where adequate irrigation water is available. Most of the land is expected to be used to produce crops for livestock feed.

CHAPTER II

EVALUATION OF DIRECT AGRICULTURAL BENEFITS TO BE EXPECTED FROM THE FLORIDA PROJECT

The evaluation of direct agricultural benefits for the project is based on the proposed facilities and the project lands to which the Bureau of Reclamation plans to furnish irrigation water. Intervening lands not included in the project have been excluded from the report. Analyses in the report reflect estimates of average management and application of practices anticipated with project development.

Evaluation Areas

To facilitate the presentation of basic agricultural data and to assist in the analysis of direct agricultural benefits, project lands were grouped into evaluation areas. Soils, climate, and water supply within each evaluation area reflect similar crop adaptations, productivity, land and irrigation development, and production costs.

The nature of the Florida project made it desirable to establish ten evaluation areas to represent without-project conditions (table 1). These areas were separated largely because of soils and irrigation water supplies which reflect differences in crop adaptations, productivity, land development and production costs. With the project, water supplies would be relatively the same and only four evaluation areas would be significant.

Evaluation areas A₁, A₂, and A₃, without the project, will become evaluation area A with the project. Likewise, evaluation areas B₁, B₂, and B₃ will become evaluation area B, and evaluation areas C₁, C₂, and C₃ will become evaluation area C. Acreages for evaluation area D are the same without and with the project.

Evaluation Area A

These lands are located on Florida Mesa and occur generally in a long strip extending north and south. Some of the lands are interspersed with lands of evaluation areas B and C. Slopes generally are three percent or less.

Soils are generally deep with loam surface textures. Subsoils take water slowly but have a high water-holding capacity. About 10 percent of the soils are very gravelly at depths between 30 and 60 inches.

The soils in this evaluation area are grouped in land capability class II 1/₁ and require moderate conservation practices for continued production over a long period of time without deterioration. They are suitable for the production of all climatically adapted crops which are generally alfalfa, small grain, corn for silage, and pasture.

1/₁ Land capability classes are in accordance with the national land capability classification, Soil Conservation Service Soils Memo No. 22, May 19, 1958.

Table 1. - Irrigable land acreage by evaluation areas, Florida project

Project lands	Evaluation areas													
	:	:	:	:	:	:	:	:	:	:	:	:	:	
	:	:	:	:	:	:	:	:	:	:	:	:	:	
	:	:	:	:	:	:	:	:	:	:	:	:	:	
	:	:	:	:	:	:	:	:	:	:	:	:	:	
	Without project:	Without project:	Without project:	Without project:	Without project:	Without project:	Without project:	Without project:	Without project:	Without project:	Without project:	Without project:	Without project:	
	A1	A2	A3	A	B1	B2	B3	B	C1	C2	C3	C	D	
Presently irrigated land	3,090	2,340	---	5,430	2,960	3,295	-----	6,255	400	445	---	845	1,190	13,720
Nonirrigated land														
Blocks of non-irrigated land ^{1/}	-----	-----	930	930	-----	-----	2,080	2,080	---	---	340	340	-----	3,350
Interspersed non-irrigated land ^{2/}	290	370	---	660	540	945	-----	1,485	85	150	---	235	-----	2,380
Total acreage without project	3,380	2,710	930		3,500	4,240	2,080		485	595	340			
Total acreage with project				7,020				9,820				1,420	1,190	19,450

1/ Presently nonirrigated land which will be used for new farms with project development.

2/ Presently nonirrigated land which will be used in conjunction with presently irrigated farms with project development.

Water supply for these lands historically has been variable depending upon water rights and the canal system which serves them. With the water supply anticipated from construction and operation of the proposed project, these lands should have the highest irrigation efficiency and crop yields of any lands within the project.

This evaluation area comprises a total of 7,020 acres of project lands. Of this amount 5,430 acres are presently irrigated and 1,590 acres are non-irrigated. The nonirrigated land can be further subdivided as follows: Nonirrigated land occurring in blocks--930 acres; nonirrigated land interspersed in small scattered tracts--660 acres.

Evaluation area A is composed of subareas A₁, A₂, and A₃ which now have water supply differences as follows:

Without Project Conditions - Evaluation area A₁ comprises presently irrigated lands with a moderate water supply shortage. Evaluation area A₂ covers presently irrigated land with a severe water shortage. Some small scattered tracts of nonirrigated land which will receive project water are also included in evaluation areas A₁ and A₂. These tracts will be used with presently irrigated lands in existing farm units. Evaluation area A₃ comprises large blocks of nonirrigated land which will receive project water and will be used for new farm units with project development.

With Project Conditions - Evaluation areas A₁, A₂, and A₃ will have the same water supply and productive capacity, and are combined as evaluation area A in the analysis.

Evaluation Area B

Evaluation area B lands are also on Florida Mesa and have soil characteristics similar to those of evaluation area A but slopes are steeper and range from 3 to 6 percent. These lands are generally located along the major drainageways in the central and southern portion of Florida Mesa but are also interspersed with lands of evaluation areas A and C. They are usually dissected by small drainageways, and as a result have short slopes and short lengths of irrigation runs.

Soils have been grouped into land capability class III because they have severe limitations requiring special management practices for long-continued cultivation.

Water supplies and farm irrigation efficiencies have been and will be about the same as for evaluation area A. Adapted crops will be the same but yields will be generally lower than for evaluation area A.

This evaluation area comprises a total of 9,820 acres of project lands. Of this amount, 6,255 acres are presently irrigated and 3,565 acres are non-irrigated. Large blocks comprise 2,080 acres of the nonirrigated land and the remaining 1,485 acres are interspersed in small tracts.

Evaluation area B is composed of subareas B₁, B₂, and B₃ which now have water supply differences as follows:

Without Project Conditions - Evaluation area B₁ covers presently irrigated lands with a moderate water supply shortage. Evaluation area B₂ includes presently irrigated lands with a severe water supply shortage. Some small scattered tracts of nonirrigated land which will receive project water are also included in evaluation areas B₁ and B₂. These tracts will be used in conjunction with presently irrigated lands in existing farm units. Evaluation area B₃ comprises large blocks of nonirrigated lands which will receive project water and will be used for new farm units with project development.

With Project Conditions - Evaluation areas B₁, B₂, and B₃ will have the same water supply and productive capacity and are combined into evaluation area B in the analysis.

Evaluation Area C

These lands are located on Florida Mesa and are generally interspersed with lands of evaluation areas A and B. Some of the soils are similar to those in evaluation areas A and B but have steeper slopes which range from 6-10 percent. Other soils in this evaluation area have slopes similar to those in areas A and B but they may be shallow over cobble or gravel, may have stones on the surface, may have developed from shale found at depths of 36-60 inches or may have developed from a mixture of alluvium from shale and material of other sources.

Soils are grouped into land capability classes III and IV. Those in land capability class III have severe limitations requiring special management and those in land capability class IV have very severe limitations requiring very careful management.

Historically, water supplies have been the same as for evaluation areas A and B. The lands will have a lower farm irrigation efficiency than areas A and B.

Projected crops are similar to those in evaluation areas A and B except corn for silage will not be grown. Average crop yields will be lower than for evaluation area B.

This evaluation area comprises a total of 1,420 acres of project lands, of which 845 acres are presently irrigated and 575 acres are nonirrigated. Of the nonirrigated land, 340 acres are located in blocks and 235 acres are interspersed in small scattered tracts.

Evaluation area C is composed of subareas C₁, C₂, and C₃ which now have water supply differences as follows:

Without Project Conditions - Evaluation area C₁ contains presently irrigated lands with a moderate water supply shortage. Evaluation area C₂ comprises presently irrigated lands with a severe water supply shortage. Some small scattered tracts of nonirrigated land

which will receive project water are also included in evaluation areas C₁ and C₂. These tracts will be used in conjunction with presently irrigated lands in existing farm units. Evaluation area C₃ comprises large blocks of nonirrigated land which will receive project water and will be used for new farm units with project development.

With Project Conditions - Evaluation areas C₁, C₂, and C₃ will have the same water supply and productive capacity and are combined into evaluation area C in the analysis.

Evaluation Area D

This area is composed of the river valley lands located along the Florida River. Lands in evaluation area D are separated from evaluation areas A, B, and C because of their location and a better water supply.

Soils range from shallow loams over gravel to deep, silty, clay loams influenced by shale. Forty percent of the lands have slopes less than 3 percent, and 90 percent have slopes less than 6 percent. Soils in this evaluation area have been grouped into land capability classes II, III, and IV.

These lands can grow any of the climatically adapted crops. Little increase in crop yields can be expected after project installation since the water supply has been nearly equal to the crop requirements.

Evaluation area D comprises a total of 1,190 acres of project lands, all presently irrigated.

Soils Inventory

Sources of Data

Existing soil surveys of individual farms, made by the Soil Conservation Service, supplied most of the information. In some areas, there was inadequate soil survey information. Here additional soil surveys were made. The soil survey information was supplemented by detailed soil profile descriptions prepared by local soil scientists of the Soil Conservation Service, and analytical data supplied by the Colorado State University Agricultural Experiment Station and the Cooperative Soil Survey Laboratory at Fort Collins, Colorado. The Bureau of Reclamation also supplied copies of the land classification field sheets and laboratory data which were useful in the appraisal of project soils.

General Description of Soils and Soil Problems

Project soils are separated into two general groups, the Florida Mesa soils representing about 90 percent and the Florida River valley soils representing about 10 percent of the land in the project.

Mesa Soils

The mesa soils have developed primarily from aeolian deposits over glacial till. They are medium textured in the surface, moderately fine textured in the subsoil, slowly permeable, and deep over gravel and cobble. A small sector in the northern part of the mesa has aeolian deposits on Animas shale or over soil developed from Animas shale. The topography of the mesa is gently to moderately rolling and the soils, unless protected, are susceptible to erosion by water and wind. Some areas of small extent, usually cultivated swales, within the project are intermittently seeped. This is due primarily to an accumulation of water as a result of inadequate removal of tail water and lateral movement of subsurface water from excessive irrigation. Larger areas with similar conditions have been excluded from the project. In general, the soils are more than 60 inches deep, have a high water-holding capacity and slow permeability. Generally the soils in the northern part of the mesa have a higher organic matter content.

River Valley Soils

The river valley is a typical small river flood plain. It is composed of a complex pattern of soils that have developed on low river terraces, and others that have developed on alluvial fans from small tributary drainages. Alluvium from the upper watershed is the source of material from which the soils adjacent to the river and those on the river terraces have developed. These soils range in depth from 10 to 36 inches over gravel and cobble. The fan soils have developed from local alluvium and colluvium of sandstone and shale origin. These materials influence the textures which vary from loam to clay loam. Depth of these soils over gravel and cobble is generally greater than the other soils in the river bottom area. In years of high runoff, soils adjacent to the river may be flooded. Also in a few low spots the water table is within 30 inches of the surface. Terrace and fan soils generally are free from overflow and water table. Soils in the northern part of the river valley are usually darker and have more profile development.

All the soils in the project require nitrogen and phosphorus fertilizer. For maximum effectiveness of the fertilizer, care must be exercised in applying irrigation water. This may require a revision of farm irrigation systems and additional land development.

Soils were grouped into land capability units as well as evaluation areas. The acreage by these units within each evaluation area is listed in table 2. General soil characteristics for each land capability unit are shown in table 3. These units, tabulated by evaluation areas, allow a general appraisal to be made of each evaluation area and of differences between evaluation areas.

Table 2. - Generalized soil-water relationship and acreages of land capability units by evaluation areas, Florida project

Evaluation areas				Land capa- bility unit	Slope	Soil depth	Water-holding capacity	
Without project		:With project:					Per foot	For soil
Presently irrigated land	: Nonirri- gated land	: Lands in evaluation area	:	:	:	:	of soil	profile
Acres				Percent		Inches		
A ₁	A ₂		A					
71	29	22	122	IIIs1	0-1	60+	2.5	13.0
30	-----	4	34	IIc1	0-1	48	2.2	9.0
-----	4	1	5	IIIs1d	0-1	30	2.0	5.0
2,463	2,031	1,296	5,790	IIe1	1-3	60+	2.5	13.0
422	130	158	710	IIe2	1-3	48+	2.3	10.0
29	101	62	192	IIe3	1-3	60+	2.4	12.0
75	45	47	167	IIeh	1-3	30	2.0	5.0
3,090	2,340	1,590	7,020					
B ₁	B ₂		B					
2,748	3,094	3,402	9,244	IIIe1	3-6	60+	2.5	13.0
82	126	58	266	IIIe2	3-6	48+	2.4	11.0
130	75	105	310	IIIe3	3-6	60+	2.4	12.0
2,960	3,295	3,565	9,820					
C ₁	C ₂		C					
4	3	14	21	IIIe5	3-6	30	2.0	5.0
4	2	3	9	IIIe6	1-3	16	2.0	2.6
31	6	28	65	IIIe7	1-3	60+	2.4	12.0
53	141	96	290	IVe1	6-10	60+	2.5	13.0
67	82	59	209	IVe3	6-10	60+	2.4	12.0
42	54	60	156	IVeh	6-10	30	2.0	5.0
24	22	24	70	IVe5	6-10	60+	2.5	13.0
130	91	221	442	IVe7	3-6	60+	2.4	12.0
45	43	70	158	IVe9	3-6	60+	2.2	11.0
400	445	575	1,420					
D								
			11	IIIs1d	0-1	48+	1.5	6.0
			15	IIc1	0-1	60+	1.6	8.0
			57	IIe1d	1-3	48	1.5	6.0
			138	IIe2	1-3	60+	1.6	8.0
			65	IIe3	1-3	60	2.4	12.0
			18	IIeh	1-3	30	1.6	4.0
			19	IIIs1d	0-1	30	1.5	4.0
			6	IIIs2d	1-3	30	1.5	4.0
			235	IIIe2	3-6	60+	1.6	8.0
			25	IIIe3	1-3	60+	2.4	12.0
			13	IIIeh	1-3	60+	2.4	12.0
			15	IVs1d	0-1	16	1.5	2.0
			42	IVs3d	1-3	16	1.5	2.0
			14	IVs4d	1-3	16	1.5	2.0
			385	IVe2	3-6	60+	2.4	12.0
			91	IVeh	6-10	54+	1.6	7.0
			27	IVe5	6-10	30	1.6	4.0
			14	IVe6	3-6	16	1.6	2.0
1,190								
Total	Total	Total	Total	D				
A-1	A-2							
B-1	B-2							
C-1	C-2							
6,450	6,080	5,730	1,190					

Project Total - 19,450 acres

Table 3. - Generalized soil characteristics by land capability units, Florida project

Land capability unit	: Acres	: Permeability	: Slope percent	: Susceptibility to erosion	: Topography	: Depth inches	: Underlying material	: Remarks
IIe1	49	Slow	0-1	Slight	Smooth	60+	Gravel	
IIsl	122	Slow	0-1	Slight	Smooth	60+	Gravel	
IIsl4	16	Slow	0-1	Slight	Smooth	30-48	Gravel	Few small spots of wet soil
IIe1	5,790	Slow	1-3	Slight	Gently rolling	60+	Gravel	
IIe1d	57	Moderate	1-3	Slight	Gently rolling	48	Gravel	
IIe2	848	Slow to moderate	1-3	Slight	Gently rolling	48-60+	Gravel	Few small spots of wet soil
IIe3	257	Slow	1-3	Slight to high	Gently rolling	60+	Gravel	
IIe4	185	Slow	1-3	Slight to high	Gently rolling	30	Gravel	Few small spots of wet soil
IIIs1d	19	Moderate	0-1	Slight	Smooth	30	Gravel	
IIIs2d	6	Moderate	0-3	Slight	Gently rolling	30	Gravel	
IIIf1	9,244	Slow	3-6	Moderate	Rolling	60+	Gravel	
IIIf2	501	Slow to moderate	3-6	Moderate	Rolling	48+	Gravel	Few small spots of saline wet soils
IIIf3	335	Slow	1-3	Slight to high	Smooth to gently rolling	60+	Gravel	
IIIf4	13	Slow	1-3	Slight to high	Smooth to gently rolling	60+	Gravel	
IIIf5	21	Slow to moderate	3-6	Moderate	Rolling	30	Gravel	Stones on the surface
IIIf6	9	Slow to moderate	1-3	Slight	Gently rolling	16	Gravel	
IIIf7	65	Slow	1-3	High	Gently rolling	48+	Shale	Shale-influenced soil
IVs1d	15	Moderate	0-1	High	Smooth	16	Gravel	
IVs3d	42	Moderate	1-3	High	Gently rolling	16	Gravel	
IVs1d	14	Moderate	1-3	High	Gently rolling	16	Gravel	Gravel surface and stratified subsoil
IVe1	290	Slow	6-10	Moderate	Rolling	60+	Gravel	
IVe2	385	Slow	3-6	High	Rolling	48+	Shale	Shale influence in profile
IVe3	209	Slow	6-10	High	Rolling	60+	Gravel	
IVe4	247	Moderate	6-10	High	Rolling	48+	Gravel	
IVe5	97	Slow to moderate	6-10	High	Rolling	30+		
IVe6	14	Moderate	3-6	High	Rolling	16		
IVe7	442	Slow	3-6	High	Rolling	48+		Shale influence in profile
IVe9	158	Slow	3-6	High	Rolling	60+	Gravel	
Project total	19,450 acres							

Evaluation Areas A and B

These two areas consist of mesa soils with all the properties described in the general description. Evaluation area A includes, in addition to the soils described above, small acreages of moderately fine textured soils, greater than 60 inches deep over gravel, and medium textured soils 30 to 48 inches deep over gravel. Slopes are three percent or less. Soils have been grouped into various units and subclasses of land capability class II because of limitations in climate, soil, and erosion that require moderate conservation practices for continued production over a long period of time without deterioration.

In addition to the soil properties in the general description above, evaluation area B also includes small acreages of moderately fine textured soils more than 60 inches deep over gravel and cobble, and medium textured soils between 36 and 60 inches deep over gravel and cobble. A few spots representing a small acreage, have a slight saline problem and high water table. The soils occur on rolling topography with slopes of three to six percent, and are grouped into units of land capability class III.

Evaluation Area C

There is a complex group of soils in this evaluation area. Surface textures are medium to moderately fine, permeability of the subsoil and substratum is moderate to slow. The soils vary from 16 to more than 60 inches deep and most of them are underlain by gravel or cobble. Small acreages of soil have stones on the surface. Based on the tabulated soil acreages, 70 percent of the soil has developed from aeolian material over glacial till and 30 percent is influenced by material of shale origin. Slopes of this area vary from 1 to 10 percent. Soils representing 93 percent of the evaluation area have been grouped into land capability class IV because of very severe limitations that require very careful management. The remainder of the area is in capability class III because of severe limitations that require special conservation practices.

Evaluation Area D

This area includes the land along the Florida River and tributary fans. Soils have developed from a complex pattern of recent river deposits, young river terraces and alluvium from side drainageways. They have medium surface textures and are moderately permeable in the subsoil and substratum. A few soils near the river, or in low spots, have water tables, but most of the water table is at least 30 inches below the surface. Slopes range from zero to 10 percent. Soils are grouped into land capability classes II, III, and IV because of limitations due to soil or erosion. Fifty percent of the land in this evaluation area is in capability class IV, 25 percent in capability class III, and 25 percent in capability class II.

Findings

The land capability classification of the 19,450 acres of land designated by the Bureau of Reclamation as the Florida project is as follows: Capability class II. 7,324 acres; III 10,213 acres; and IV 1,913 acres. It is concluded that the Florida project lands are suitable for cultivation under irrigation.

Irrigation Requirements and Water Supplies

Sources of Data

There are several studies which include estimates of irrigation requirements in the general vicinity of the Florida project. Among these studies are: (1) Appendix B of the Record of the Upper Colorado River Basin Compact Commission; (2) Consumptive Use and Irrigation Water Requirements of Crops in Colorado, by Harry F. Blaney and Wayne D. Criddle; and (3) Consumptive Use of Water in the Irrigated Areas of the Upper Colorado River Basin, by Blaney and Criddle. Additional related information is contained in the Water Supply Papers of the U.S. Geological Survey, Climatological Data by the U.S. Weather Bureau, Colorado Heat and Moisture Indexes for Use in Land Capability Classification by the Soil Conservation Service, and other publications. These and other available related reports were carefully reviewed for the purpose of this study. In addition, information was supplied by technicians of the Colorado State University, Colorado Agricultural Experiment Station, Colorado Cooperative Extension Service, Colorado State Engineer, Agricultural Research Service, U.S. Bureau of Reclamation, U.S. Soil Conservation Service, and others familiar with the area.

Analysis of Data

Consumptive use requirements for the principal crops in the area were estimated by the Blaney-Criddle procedures (table 4). The various irrigation water losses expected within the project were estimated by considering soil characteristics and site locations. Total farm water requirements were estimated by adding on-farm losses to the basic consumptive use estimates weighted by projected crop acreage distribution (table 5).

Table 4. - Estimate of consumptive use requirements for major crops, Florida project

	: Alfalfa	: Pasture	: Corn	: Small grain
<u>Frost-free period</u>				
Consumptive use coefficient	.85	.75	.75	.75
Consumptive use factor	22.74	22.74	22.74	19.04
Consumptive use, ac. ins./ac.	19.32	17.05	17.05	14.28
<u>Nonfrost-free period</u>				
Consumptive use coefficient	.70	.60	-----	-----
Consumptive use factor	8.44	8.44	-----	-----
Consumptive use, ac. ins./ac.	5.90	5.06	-----	-----
Total consumptive use, ac. ins./ac.	25.22	22.11	17.05	14.28
Effective seasonal precipitation, ins.	5.88	5.88	4.30	3.38
Net consumptive use requirements, ac. ins./ac.	19.34	16.23	12.75	10.90

Table 5. - Irrigation requirements by evaluation areas, Florida project

	Evaluation areas				Project total
	A	B	C	D	
Weighted average consumptive use requirements, acre-inches/acre	15.4	15.4	14.7	16.0	15.4
Weighted average field application efficiency, percent	60	55	43	52	56
Weighted average farm irrigation efficiencies, percent	55	54	39	47	53
Farm headgate water delivery requirement, acre-inches/acre	28.0	28.5	37.7	34.0	29.0

Irrigation water for the Florida project is now supplied by direct diversions from natural flow of the Florida River. The river water is of a quality suitable for irrigation, and estimates of irrigation losses include sufficient allowance for deep percolation to permit adequate leaching of the profile for salt control. The flow of the river is quite variable. Runoff in excess of immediate irrigation requirements occurs during the spring snow-melt period. Streamflow diminishes during the late summer until it is inadequate to supply the crop requirements for irrigation water. There is no reservoir in which to store excess spring runoff water until needed. Total annual runoff from the river is more than adequate in most years to furnish a full water supply to all the present farmlands and the proposed new lands within the project area.

Delivery of irrigation water to the farmlands is now made by means of a complex network of some 74 diversions and ditches or canals. Of these, two major systems serve most of the lands on Florida Mesa which make up evaluation areas A, B, and C. The remaining canals or ditches generally serve small areas of the valley lands comprising evaluation area D, often a single farm. Distribution of water is made in accordance with an intricate system of water rights. Frequently, both senior and junior water rights overlap the same parcel of land. Occasionally, individual farms include several water rights with wide differences in seniority.

As a result, particularly on the mesa lands, there has been a wide range of adequacy of water supplies in different parts of the area. The 12,530 acres presently irrigated on the mesa can be generally subdivided under without project conditions into two levels of water supply. These lands are not necessarily physically separated, but instead are frequently intermingled in accordance with the pattern of ownership of the various water rights.

Approximately 6,450 acres, designated as evaluation subareas A₁, B₁, and C₁, have water rights with earlier priority dates than the remainder of the presently irrigated mesa lands. Since these lands have senior rights, they have first call on available water supplies within their distribution systems and hence have a comparatively better water supply than the remainder of the area. The better water supply has been reflected in higher yields and in more desirable cropping patterns. Average irrigation water supply available to this area during the 1928-56 study period is estimated at approximately 65 percent of requirements.

The remaining 6,080 acres of presently irrigated mesa lands are designated as evaluation subareas A₂, B₂, and C₂. They have water right priorities that are later than those for areas A₁, B₁, and C₁. Average irrigation water supply available to this area for the 1928-56 study period is estimated at 50 percent of requirements. Commonly they receive no water subsequent to July 1, hence are restricted to smaller acreages of alfalfa and pasture and larger acreages of short-season crops such as wheat or barley.

Lands in the Florida River valley comprise evaluation area D. They generally have water rights relatively senior in priority date. In addition, most are so situated that they are able to divert return flow from higher lands upstream or on the mesa, hence have a nearly adequate water supply.

Under project operations, all lands will have a full water supply except in occasional years of extremely deficient runoff. A comparison of the adequacy of water supplies for these areas is given in table 6.

The project plan proposes the construction of Lemon Dam and Reservoir on Florida River upstream from the project lands. This reservoir will provide a means of regulating the river so that the inadequate late-season flows can be supplemented with stored water in sufficient quantity to provide an adequate irrigation supply in most years. The storage capacity would be sufficient to provide an adequate water supply for presently irrigated project lands and to the proposed new lands in all but years of exceptionally deficient runoff. A comparison of historical water supplies, and those that would be available with the project, based on data provided by the Bureau of Reclamation, is given in table 7.

Table 6. - Average water supply, percent of requirements, Florida project

Month	: Historical water supply without project 1/			: Projected water supply with project 2/		
	: Evaluation areas: Evaluation area:			: Evaluation areas : Evaluation area		
	: A1, B1, & C1	: A2, B2, & C2	: D	: A, B, & C	: D	
	Percent					
May	100	100	97	100	100	
June	56	54	92	100	100	
July	36	21	89	95	98	
August	30	9	90	92	98	
September	24	6	92	91	97	
October	100	29	96	93	100	

1/ Based on 1946-56 period, except area D on which no detailed diversion records are available, is based on 1928-56 water supply study.

2/ Based on ideal demand and 1928-56 water supply study.

Table 7. - Comparison of seasonal water supply without and with project, Florida project

Water supply within requirements	Percent of years equalled or exceeded			
	Florida Mesa lands		Florida Valley lands	
	Evaluation areas A, B, & C		Evaluation area D	
	With project	Historical W/O project	With project	Historical W/O project
- - Percent - -				
100	71	1	68	12
90 or better	75	5	94	52
80 or better	81	15	100+	91
70 or better	87	30	---	100+
60 or better	91	50	---	---
50 or better	98	73	---	---

Findings

Based on estimates of consumptive use requirements and irrigation efficiencies, an average 2.42 acre-feet of water per irrigable acre will be required at the farm headgates to adequately serve the project lands. Reservoir operation studies, based on historical flows of the Florida River, indicate that water supplies available from project facilities will be adequate to meet this requirement in all but exceptionally dry years. The average water supply available for delivery to farmers during a period of years comparable to the 1928-56 study period (which includes the driest series of years on record) would be 94 percent of estimated requirements. An average of seven out of ten years would have a water supply adequate to meet all crop requirements. The project water supply and requirements are summarized in table 8.

Table 8. - Projected crop distribution and seasonal consumptive use and water requirement estimates by evaluation areas, Florida project

Crop	Evaluation area A				Evaluation area B				Evaluation area C				Evaluation area D				Project total			
	Estimated net seasonal consumptive use requirements	Productive: acres	Total net irrigation requirements	Acre- inches	Productive: acres	Total net irrigation requirements	Productive: acres	Acre- inches	Productive: acres	Total net irrigation requirements	Productive: acres	Acre- inches	Productive: acres	Total net irrigation requirements	Productive: acres	Acre- inches	Productive: acres	Total net irrigation requirements		
<hr/>																				
Alfalfa	19.34	3,060	59,180		4,141	80,087	355	6,866	708	13,693	8,264	159,826								
Pasture	16.23	1,710	27,753		2,544	41,289	608	9,868	107	1,737	4,969	80,647								
Corn	12.75	450	5,737		592	7,548	---	---	96	1,224	1,138	14,509								
Small Grain	10.90	1,440	15,696		2,070	22,563	386	4,207	225	2,453	4,121	44,919								
Total		6,660	108,366		9,347	151,487	1,349	20,941	1,136	19,107	18,492	299,901								
<hr/>																				
Acre-feet			9,030.5			12,623.9		1,745.1				24,991.7								
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Weighted average farm irrigation efficiency, percent			55			54		39			47	53								
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Weighted average farm delivery requirement acre-feet			16,419			23,378		4,475			3,388	47,154								
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Acre-feet per productive acre			2.46			2.50		3.31			2.98	2.55								
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Less water allotted to noncrop areas reserved for farmsteads, rights- of-way, etc.			0.13			0.13		0.17			0.15	0.13								
<hr/>																				
Net farm headgate delivery require- ment, ac. ft. per irrigable acre						2.41 ^{1/}					2.83	2.42								
<hr/>																				
Proposed project average water delivery at farm headgate, acre-feet per irrigable acre																				
<hr/>																				
Percent of water requirements which will be met by proposed average delivery						2.26 ^{1/}					2.72	2.28								
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											94 ^{1/}	94								

^{1/} Weighted average of Florida Mesa Lands, Evaluation Areas A, B, and C.

Land and Irrigation Development

Sources of Data

Soil surveys are available for a representative acreage within the project area. These surveys are generally interpreted in terms of land use and recommended treatment as provided in the technical guide of the La Plata Soil Conservation District. Land classification surveys of the Bureau of Reclamation furnish supplemental information. Direct inspection of field conditions and review with technicians familiar with the area have furnished additional basic data. Farm plans and records of land leveling and farm irrigation development work accomplished with the assistance of Soil Conservation Service technicians, assigned to the La Plata Soil Conservation District, have been used to obtain basic estimates of unit volumes and costs.

The analysis reflects an estimate of the average management and application of practices anticipated as a result of the project development.

Development requirements have been related to the physical characteristics of the various soil units on the project. Amounts of development necessary to be accomplished, and especially the requirements or limitations that are imposed by the soil and site characteristics, have been estimated by each soil unit and averaged by evaluation areas. Interspersed lands not included in the project have been excluded from the report. Cost estimates are based on the U.S. Department of Agriculture price projections of September, 1957.

Analysis of Data

Irrigation water supplies for the project area have been inadequate for the presently cultivated lands, hence there has been no development of new lands in recent years. Only on those lands with the better water rights has any significant amount of development been accomplished since the original subjugation and initial development of the land. Even on these lands, recent development work has been largely restricted to the improvement of specific problem areas where conditions resulted in unusual difficulty in obtaining adequate irrigation.

Under present water supply conditions, there has been little economic incentive or capacity to develop land at a rate greater than has occurred. It is expected, therefore, that in the future without the project, conditions will remain little changed from the present, and that additional development work would be largely limited to the amelioration of severe problem areas.

With project development, the increased water supply and resulting better yields will provide a basis for increased development. There are only limited data on which to base an estimate of the rate of increase in land and irrigation development that can be expected under these changed conditions. However, an approach has been made by extending the present rate by percentage of area covered, and adjusted to the requirements of the various soil units and site factors. Based on this procedure, estimates of land development requirements associated with project construction have been made and projected to the various evaluation areas. These are summarized in table 9.

Table 9. - Summary of land and irrigation development requirements,
Florida project

Item	Unit	Evaluation area			
		A	B	C	D
Irrigable land	Acres	7,020	9,820	1,420	1,190
Dominant slopes	Percent	1-3	3-6	6-10	3-6
Dominant profile depth	Feet	5	5	5	5
Dominant irrigation method	Type	Corru- gation	Corru- gation	Corru- gation	Corru- gation
Average farm irrigation efficiency	Percent	55	54	39	47
Average maximum lengths of run	Feet	645	250	260 ^{1/}	450
Field ditch & lateral re- quired for project acreage	Feet/acre	100	130	175	95
Weighted average leveling earthwork for project acreage	Cy./ac.	139	130	120	75
Average leveling earthwork, per acre leveled	Cy./ac.	367	226	227	300
Estimated average clearing cost, per acre cleared	Dollars	30.00	12.75	14.00	---
Ditch structures, estimated cost per acre for project acreage	Dollars	2.37	6.40	8.96	2.55

^{1/} Includes 274 acres with irrigation runs of 330 to 660 feet due to flat slopes and restricted intakes.

Soils of the project are generally typified by profiles which have a high total water-holding capacity and a generally low basic intake rate. Considerable areas will require little or only very limited amounts of development. However, while on much of the project gradients are comparatively steep, lengths of run will be limited more frequently by surface undulations than by slopes or profile characteristics. These factors have a material effect upon good irrigation design and hence on the land and irrigation development costs. Surface undulations are particularly severe on many soil units in evaluation areas B and C. They markedly influence cost

estimates for land leveling and farm irrigation system requirements since they directly affect irrigation design and layout, and irrigation efficiency.

There are some limited areas of seeped lands included within the perimeter of the project area. Soils of these areas have low permeabilities and drainage is not economically practicable. These and adjacent areas susceptible to seepage have been excluded from the project.

Some small areas of project lands are intermittently wet due to inadequate tail water removal and lateral seepage from excessive irrigation. However, project lands are generally underlain by deep beds of porous, well drained gravels and cobbles and there is no indication that they are susceptible to seepage or drainage problems which cannot be corrected by good irrigation practices and land development. Accordingly, no drainage costs are anticipated for project lands.

Areas with a stony surface or profile represent less than one percent of the project lands. Cost of rock and stone removal on these lands would be excessive. It has been assumed they would be restricted to pasture crops and would not require rock or stone removal for their utilization. No costs have been estimated for this purpose.

Findings

Estimates of development costs for project lands are based on an analysis of the physical requirements of the soils and site conditions. They are related to project economic conditions and to the minimum requirements for land and water management at the levels expected under project conditions. Weighted average development cost estimates are summarized by evaluation areas in table 10.

Table 10. - Cost of land and irrigation development by evaluation areas, Florida project

Evaluation area	: <u>Estimated weighted average cost per acre</u> :			Total weighted average cost per acre
	:	:	: Farm :	
	: Clearing	: Leveling	: irrigation :	
	:	:	: system :	
<hr/>				
	<u>Dollars</u>			
A	3.21	27.81	5.84	36.86
B	2.18	26.16	11.03	39.37
C	2.53	23.84	15.13	41.50
D	----	15.00	4.75	19.75

Based upon price projections by the U.S. Department of Agriculture, September 1957.

Projected Agricultural Economy

Economic analysis of the proposed Florida irrigation project has two primary objectives: (1) An appraisal of direct agricultural benefits from project development; and (2) an appraisal of prospective farm incomes from representative sizes and types of farms considered most likely with proposed irrigation development. Both of these analyses contribute to a general appraisal of the prospects for a successful, stable irrigated agricultural economy.

Procedures

An estimate of agricultural benefits and an appraisal of prospective farm incomes were derived by farm budgeting procedures. Crop-production budgets were used for the analysis of agricultural benefits and were limited to costs and returns of crops and pasture production that would exist with a livestock economy. Farm-income budgets were used in the analysis of prospective farm incomes by types of farms. In this analysis, costs and returns were carried through the livestock enterprises. The farm acreages, cropping systems, and crop yields established for appraisal of farm incomes were used in budgeting for agricultural benefits.

The crop-production budgets consist of three basic elements: (1) The estimated quantity and value of crops and pasture anticipated after full development of the land and farms; (2) the quantity and value of economic resources employed in achieving the assumed level of production (exclusive of water costs); and (3) the delay involved in achieving the ultimate level of production which is accounted for by discounting procedures.

Farm-income budgets, representing costs and returns of all the enterprises anticipated for given farm types, are used for estimating the residual incomes. These incomes are available as compensation to farm operators and their families for their labor and management, and for payment of water charges. The major elements involved in this analysis are: (1) The quantity of agricultural products produced for sale and their expected market values; (2) the quantity and value of resource inputs that must be expended by project farmers to achieve the level of production anticipated (exclusive of water costs); and (3) an allowance for the labor and management of the operator and family equivalent to estimated incomes that would be derived from alternative year-round employment off the project.

Sources of Data

Numerous economic studies of irrigation development have been relied upon for the economic and physical standards, and the procedures used in the analysis. This background information was supplemented by specific information for the Florida project obtained from four major sources: (1) An economic survey of farms in the project area conducted during 1958 by the U. S. Bureau of Reclamation and the U. S. Department of Agriculture; (2) material furnished by the U. S. Bureau of Reclamation; (3) economic analyses of other projects; ^{1/} and (4) information furnished by Colorado State University personnel, local representatives of federal and state agencies and local businessmen.

Commodity Price Projections

All prices used for estimating farm incomes, direct benefits, and associated costs are based upon the September 1957 price projections of the U. S. Department of Agriculture. These projections assume "relatively high employment, a trend toward peace, continued population and economic growth, and a stable general price level."

The long-term projected index of prices received for all farm commodities is 235, base period 1910-14. A comparable index for prices paid, including interest, wages and taxes, is 265.

The price of rotation pasture used in the benefit analysis is derived from the long-term projected price of alfalfa. The computed price is based on the net income derived from alfalfa, adjusted for differences in costs of production and per-acre yield of total digestible nutrients. The derived price results in the same net return per acre for alfalfa hay and rotation pasture.

Information obtained during the field survey showed that, historically, prices received locally for specific agricultural commodities marketed in Colorado or New Mexico have been about the same as the state average prices. Projected prices of commodities for the States of Colorado and New Mexico were adjusted for transportation and marketing costs. Projected prices of crops, livestock, livestock products and selected cost items for the Florida project are shown in table 11.

^{1/} Reappraisal of Direct Agricultural Benefits for the Vernal Unit, Central Utah project, and Paonia, Hammond, Smith Fork and Seedskadee projects, Colorado River Storage Project.

Table 11.- Long-term projected prices received and selected prices paid,
Florida project

Product	Unit	Price <u>1/</u> <u>Dollars</u>
<u>Prices received</u>		
Alfalfa, baled <u>2/</u>	Ton	21.90
Straw, baled	Ton	10.00
Corn silage <u>3/</u>	Ton	7.80
Barley	Bu.	1.10
Market milk (b.f.) <u>4/</u>	Lb.	1.16
Grade A	Lb.	1.35
Manufacturing	Lb.	.71
Calves (beef steer)	Cwt.	21.10
Calves (beef heifer)	Cwt.	18.80
Long yearlings (beef steer)	Cwt.	19.50
Long yearlings (beef heifer)	Cwt.	17.10
Cull cows (beef)	Cwt.	15.10
Cull cows (dairy)	Cwt.	12.90
Lambs	Cwt.	21.10
Cull ewes	Cwt.	5.90
Wool	Lb.	.49
<u>Prices paid</u>		
Hired labor	Hr.	1.00
Custom rates:		
Baling hay	Ton	5.00
Combining grain	Ac.	5.00

1/ Net prices received by farmers.

2/ Price in stack after shrinkage.

3/ Based upon the price of alfalfa; 2.8 tons of corn silage equivalent to 1 ton of alfalfa.

4/ Weighted average includes 70 percent grade A and 30 percent grade C at 3.5 test.

Based upon price projections by the U. S. Department of Agriculture, September 1957.

Farm Sizes

Present size of farm operating units surveyed are somewhat larger than encountered in most irrigated areas of the Upper Colorado River Basin. Irrigated acreage of farms surveyed averaged about 150 acres per farm. The sample did not include small farms.

The projected average farm size is based on a family-size farm concept in which the operator and his family furnish all the labor except during the crop harvesting season. Present sizes, current trends in size of farms, legal limitation of 160 acres of irrigable land per farm ownership, prospective farm incomes, and other factors were considered in establishing projected farm sizes.

There are 5,730 acres of arable nonirrigated land in evaluation areas A, B, and C suitable for irrigation. Of this area, 2,380 acres lie in small, scattered tracts on existing farms and are projected to be developed in conjunction with land already under irrigation. The remaining 3,350 acres of arable nonirrigated land lie in contiguous tracts and will provide an opportunity for the establishment of new farms.

Anticipated Crop Yields

Projected crop yields estimated for evaluation areas, without and with the project, are shown in table 12. Production estimates are based on crop yields obtained in comparable areas, estimates by project farmers and agricultural technicians familiar with the area, and other pertinent crop yield data. Yields reflect estimates of average managerial skill for farmers on the project.

Table 12.- Projected crop yields without and with project, by evaluation areas, Florida project

Crop	: Unit :	Evaluation areas										
		W/O	W	W/O	W	W/O	W	W/O	W	W/O	W	
		A ₁	A ₂	A	B ₁	B ₂	B	C ₁	C ₂	C	D	D
Alfalfa 1/	Ton	2.8	2.0	3.5	2.5	1.7	3.1	2.0	1.4	2.7	2.5	2.7
Rot. past. 1/	AUM	5.6	4.0	7.0	5.0	3.4	6.2	4.0	2.8	5.4	5.0	5.4
Corn silage	Ton	10.0	----	13.0	8.0	----	11.0	----	----	----	9.0	10.0
Barley	Bu.	50.0	43.0	55.0	46.0	40.0	50.0	42.0	37.0	45.0	47.0	47.0
Perm. past.	AUM	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0

1/ Fertilizer, without project: Annual rate for evaluation areas A₁, B₁, and C₁, alfalfa, 10 pounds available P₂O₅ or equivalent manure per acre; rotation pasture, 10 pounds available P₂O₅ and 10 pounds N or equivalent manure per acre. Total P₂O₅ required applied at time of seeding. Nitrogen applied annually. Fertilizer rates for evaluation area D will be the same as in the with situation.

Fertilizer, with project: Annual rate; alfalfa, 20 pounds available P₂O₅ or equivalent manure per acre; rotation pasture, 20 pounds available P₂O₅ and 20 pounds N or equivalent manure per acre. Total P₂O₅ required applied at time of seeding. Nitrogen applied biennially.

Anticipated Cropping Systems

Climatic conditions, topography, and distance to central markets are limiting factors to the kinds of crops that can be commercially produced in the project area. Present irrigated land use consists of 53 percent of the cropland in alfalfa, clover and pasture, 30 percent in small grains, 4 percent in corn for silage and 13 percent, idle and fallow. Development of the project is not expected to affect the kinds of crops produced. No intensive cash crops are expected to be grown on the Florida project on a commercial scale.

Development of the project is expected to increase acreage of forage crops and reduce acreage of grain crops (table 13). A 7-year crop rotation, including 5 years of alfalfa or rotation pasture, and 2 years of grain and corn for silage, is assumed on lands in evaluation areas A, B, and D. Evaluation area C is assumed to be limited to a rotation of 5 years of alfalfa or rotation pasture and 2 years of grain. Small grain is grown alone the first year for weed control purposes and is used as a nurse crop in seedings of alfalfa or rotation pasture the second year.

Direct Agricultural Benefits

A primary objective of the economic analysis is to estimate direct agricultural benefits. These benefits are defined as the value of crop and pasture production expected with project development in excess of production anticipated without the project, less the value of additional farm inputs or associated costs required. The concepts and assumptions on the specific composition and value of nonproject resources or associated costs, as used in this report, are outlined below.

A basic assumption is that the national economy will operate at essentially full employment for the period of analysis. Based on this general assumption, alternative employment opportunities would be expected in the national economy for resources used in the development and operation of irrigated farms, including the labor and management skills of farm operators. Also, the projected levels of farm prices received and paid are higher than they would be with a significant amount of unemployment.

Estimates of direct agricultural benefits are based upon crop-production budgets that account for the quantity and value of crop and pasture production expected after full development of project farms, and the cost that will be incurred on the project lands in achieving the level of production expected. Separate estimates have been made for each evaluation area and a total computation for the project area as a whole.

The cropping patterns assumed in the benefit analysis are the same as used in the analysis of water requirements and prospective farm incomes.

Farms with an adequate water supply will require considerably more labor, including operator and family labor, than farms with partial water supplies. In the with project budgets, the additional operator and family labor required is considered as an expense in deriving benefits.

Table 13.- Projected cropping pattern, without and with project development, by evaluation areas, Florida project

Crop	Evaluation areas																
	Without project		With : pro- : ject :	Without project		With : pro- : ject :	Without project		With : pro- : ject :	Without project		With : pro- : ject :	Without project		With : pro- : ject :	Total : without: project:	Total : with project:
	A1	A2	A3	A	B1	B2	B3	B	C1	C2	C3	C	D	D	D	:	:
Alfalfa	1,437	787	-----	3,060	1,268	1,044	-----	4,141	87	66	-----	355	697	708	5,386	8,264	
Rotation pasture	656	319	-----	1,710	698	521	-----	2,544	183	142	-----	608	118	107	2,637	4,969	
Corn silage	196	-----	-----	450	190	-----	-----	592	-----	-----	-----	-----	96	96	482	1,138	
Barley	628	1,092	-----	1,440	635	1,528	-----	2,070	106	207	-----	386	225	225	4,421	4,121	
Range, nonirrigated	290	220	240	-----	540	600	540	-----	85	90	80	-----	-----	-----	2,685	-----	
Cultivated, nonirrigated	-----	150	690	-----	-----	345	1,540	-----	-----	60	260	-----	-----	-----	3,045	-----	
Farmstead, etc.	173	142	-----	360	169	202	-----	473	24	30	-----	71	54	54	794	958	
Total	3,380	2,710	930	7,020	3,500	4,240	2,080	9,820	485	595	340	1,420	1,190	1,190	19,450	19,450	
Permanent pasture 1/	120	90	60	270	110	130	140	380	15	15	20	50	1,010	1,010	1,710	1,710	

1/ Nonproject lands projected to receive essentially the same supply of water without and with the project.

Labor and Management Charges

Labor for crop production on the Florida project will be required and performed during several summer months. Thus, the summer hired wage rate assumed in the analysis has been applied to operator and family labor in the evaluation of direct agricultural benefits from irrigation water. This rate is \$1.00 per hour. A management allowance or charge also has been made for the farm operators. This amounts to 15 percent of the hired wage rate. Based on the above rates and an allocation of 75 percent of the hours to the operator and 25 percent of the hours to the family, the hourly rate would be \$1.11 per hour.

Return to Land and Water

A summary of the average value of crop production, annual production costs, return to operator and family labor and management, land and water, without and with the project, is shown by evaluation areas in tables 14 and 15. Net income, cost of operator and family labor and management and weighted average increase in net income with project by evaluation areas are shown in table 16. Deduction of all expenses and allowances, except for land and water, leaves a weighted average net return to these resources ranging from \$15.94 per acre for area A to \$2.83 per acre for area D.

Land Development Costs

The acreage of each evaluation area, the projected land values and the additional cost of land and farm irrigation systems, and annual cost per acre are shown in table 17. Costs of farm buildings, machinery, fences, domestic water, and maintenance and replacement costs of the farm irrigation system are included as farm expenses in the budgets. Man and machine labor have been aligned with the degree of development of land and farm irrigation systems projected for each evaluation area.

Projected additional investments in land improvements and development of farm irrigation systems, per irrigable acre required with project development, for evaluation areas A, B, C, and D are \$42.16, \$47.84, \$51.07, and \$19.75, respectively. At five percent the annual amortized average costs per acre for the total additional investments required would be \$2.15, \$2.46, \$2.64, and \$1.02.

Development Period

Benefits from the use of supplemental water would begin to accrue immediately after completion of the project. The 2,380 acres of nonirrigated land which lies in small, scattered tracts are projected to be developed in conjunction with land already under irrigation. Development of the 3,350 acres of non-irrigated land, on which new farms are projected to be established is likely to proceed at a slower rate. Several years may elapse before the full level of benefits is attained. The assumption is made for the Florida project that a period of three years will be required before the full level of projected benefits are achieved on the presently irrigated and intermingled new lands, and five years will be required for lands on which new farms are projected. These periods are used for discounting purposes.

Table 14.- Net income from crop production to operator and family labor and management, land and water, without project by evaluation areas, Florida project

Item	Unit	Evaluation areas						
		A ₁	A ₂	B ₁	B ₂	C ₁	C ₂	D
Total land	Acres	157	157	167	167	180	180	111
Alfalfa	Acres	68	46	63	41	33	20	65
Rotation pasture	Acres	28	17	31	19	69	42	11
Corn silage	Acres	9	-----	9	-----	-----	-----	9
Small grains	Acres	30	63	30	60	40	62	21
Range, nonirrigated	Acres	14	14	26	26	29	29	-----
Cultivated, nonirri- gated	Acres	-----	9	-----	13	-----	18	-----
Farmstead, etc.	Acres	8	8	8	8	9	9	5
Operator and family labor	Hours	1,299	1,011	1,324	1,016	1,260	959	1,526
Investment	Dollars	10,104	9,045	9,846	8,978	9,150	8,962	9,913
Buildings and improve- ments	Dollars	2,442	2,133	2,399	2,174	2,310	2,310	2,300
Machinery and equip- ment	Dollars	6,420	6,367	6,420	6,367	6,454	6,454	6,525
Other	Dollars	1,242	545	1,027	437	386	198	1,088
Value of production	Dollars	7,745	5,548	6,773	4,742	5,533	4,102	5,727
Production expenses <u>1/</u>	Dollars	3,515	3,145	3,488	3,095	3,101	3,065	3,718
Net crop income <u>2/</u>	Dollars	4,230	2,403	3,285	1,647	2,432	1,037	2,009
Interest <u>3/</u>	Dollars	505	453	493	449	458	448	496
Net income <u>4/</u>	Dollars	3,725	1,950	2,792	1,198	1,974	589	1,513

1/ Excluding interest, land and water development, and O&M.

2/ Return to operator and family labor and management, capital, land and irrigation water.

3/ At 5 percent.

4/ Return to operator and family labor and management, land and irrigation water.

Based upon price projections by the U. S. Department of Agriculture, September 1957.

Table 15.- Net income from crop production to operator and family labor and management, land and water, with project by evaluation areas, Florida project

Item	Unit	Evaluation areas			
		A	B	C	D
Total land	Acres	154	156	160	111
Alfalfa	Acres	68	64	32	66
Rotation pasture	Acres	37	42	77	10
Corn silage	Acres	9	9	-----	9
Small grains	Acres	32	33	43	21
Farmstead, etc.	Acres	8	8	8	5
Operator and family labor	Hours	1,664	1,730	1,658	1,545
Investment	Dollars	10,533	10,217	9,194	10,004
Buildings and improvements	Dollars	2,544	2,468	2,220	2,300
Machinery and equipment	Dollars	6,420	6,420	6,454	6,525
Other	Dollars	1,569	1,329	520	1,179
Value of production	Dollars	10,198	9,121	7,575	6,092
Production expenses <u>1/</u>	Dollars	3,977	3,925	3,440	3,744
Net crop income <u>2/</u>	Dollars	6,221	5,196	4,135	2,348
Interest <u>3/</u>	Dollars	526	511	460	500
Net income <u>4/</u>	Dollars	5,695	4,685	3,675	1,848

1/ Excluding interest, land and water development, and O&M.

2/ Return to operator and family labor and management, capital, land and irrigation water.

3/ At 5 percent.

4/ Return to operator and family labor and management, land and irrigation water.

Based upon price projections by the U. S. Department of Agriculture, September 1957.

Table 16.- Summary: Weighted average increase in net income with project, by evaluation areas, Florida project

Item	Land : Net in- : Operator and : Cost of opera- : Net in- : Weighted : Net income : Increased net			area : come 1/ : family labor : labor 2/ : come 3/ : farm size : per acre 3/ : income per acre : income per acre			: with project		
	Evaluation area	Acres	Dollars	Hours	Dollars	Acres	Dollars	Dollars	Dollars
A		7,020	5,695	1,664	1,851	154	3,844	24.96	----
A1		3,380	3,725	1,299	1,445	157	2,280	14.52	10.44
A2		2,710	1,950	1,011	1,125	157	825	5.25	19.71
A3		930	-----	-----	-----	---	-----	-----	24.96
Weighted average, A									15.94
B		9,820	4,685	1,730	1,925	156	2,760	17.69	----
B1		3,500	2,792	1,324	1,473	167	1,319	7.90	9.79
B2		4,240	1,198	1,016	1,130	167	68	.41	17.28
B3		2,080	-----	-----	-----	---	-----	-----	17.69
Weighted average, B									14.70
C		1,420	3,675	1,658	1,844	160	1,831	11.44	----
C1		485	1,974	1,260	1,402	180	572	3.18	8.26
C2		595	589	959	1,067	180	-478	-2.66	14.10
C3		340	-----	-----	-----	---	-----	-----	11.44
Weighted average, C									11.47
D		1,190	1,848	1,545	1,719	111	129	1.16	----
D		1,190	1,513	1,526	1,698	111	-185	-1.67	2.83

1/ Return to operator and family labor and management, land and irrigation water.
2/ At \$1.15 per hour for operator labor and management and \$1.00 per hour for family labor. Weighted average is based on 75 percent of hours by operator and 25 percent of hours by family.
3/ Net return to land and irrigation water.

Table 17.- Estimated average annual additional cost per acre of irrigable land for land and land development, by evaluation areas, Florida project

Item	Evaluation areas									
	A ₁	A ₂	A ₃	B ₁	B ₂	B ₃	C ₁	C ₂	C ₃	D
Land area, acres	3,380	2,710	930	3,500	4,240	2,080	485	595	340	1,190
Land values										
Irrigated land	\$180.00	\$120.00	-----	\$170.00	\$110.00	-----	\$160.00	\$100.00	-----	\$150.00
Dry cropland	-----	50.00	\$50.00	-----	50.00	\$50.00	-----	50.00	\$50.00	-----
Rangeland	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	-----
Weighted average	165.00	107.00	40.00	145.00	91.00	40.00	134.00	81.00	40.00	150.00
Additional land investment										
Land	-----	-----	40.00	-----	-----	40.00	-----	-----	40.00	-----
Land clearing	2.75	2.60	6.71	2.31	2.12	2.08	2.63	2.27	2.82	-----
Land leveling	24.86	25.68	44.76	23.44	23.97	35.19	21.68	21.89	30.30	15.00
Farm irrigation system	4.68	4.82	13.00	9.04	9.16	18.20	13.47	13.53	20.31	4.75
Total	32.29	33.10	104.47	34.79	35.25	95.47	37.78	37.69	93.43	19.75
Weighted average	1/42.16	1/42.16		1/47.84	1/47.84		1/51.07	1/51.07		19.75
Annual cost										
Land 2/	1.39	1.42	4.61	1.30	1.31	3.89	1.22	1.22	3.68	.76
Farm irrigating system 3/	.26	.26	.71	.50	.50	1.00	.74	.74	1.11	.26
Total	1.65	1.68	5.32	1.80	1.81	4.89	1.96	1.96	4.79	1.02
Weighted average	1/2.15	1/2.15		1/2.46	1/2.46		1/2.64	1/2.64		1.02

1/ For evaluation areas A, B, and C, respectively.

2/ Land, land clearing, and land leveling; amortized over a 100-year period at 5 percent interest (factor .05038).

3/ Farm irrigation system; amortized over a 50-year period at 5 percent interest (factor .05478).

Based upon price projections by the U. S. Department of Agriculture, September 1957.

Findings

Increased net income per acre with project for evaluation areas A, B, C and D are \$15.94, \$14.70, \$11.47 and \$2.83, respectively (table 18). Annual amortized cost of additional land investment and development ranges from \$1.02 per acre for evaluation area D to \$2.64 for evaluation area C. Weighted discount factors are based on three- and five-year development periods, an interest rate of five percent, and an evaluation period of one hundred years.

The present annual equivalent value of direct agricultural benefits for evaluation areas A, B, C, and D are estimated to be \$13.03, \$11.54, \$8.34, and \$1.72 per acre, respectively. The weighted average for the entire 19,450 acres is \$11.24 per acre, or about \$219,000 annually for the proposed project.

Table 18.- Summary of estimated annual direct agricultural benefits, by evaluation areas, Florida project

Evaluation area	Land area	Increased net income with project		Amortized cost of additional land investment and development		Direct benefits		Discount factor 1/	Net direct benefits	
		Per acre	Total	Per acre	Total	Per acre	Total		Per acre	Total
A1	3,380	\$10.44	\$35,287	\$1.65	\$5,577	\$8.79	\$29,710	2/.95271	\$8.37	\$28,305
A2	2,710	19.71	53,414	1.68	4,553	18.03	48,861	2/.95271	17.18	46,550
A3	930	24.96	23,213	5.32	4,948	19.64	18,265	3/.90844	17.84	16,593
A	7,020	15.94	111,914	2.15	15,078	13.79	96,836		13.03	91,448
B1	3,500	9.79	34,265	1.80	6,300	7.99	27,965	2/.95271	7.61	26,642
B2	4,240	17.28	73,267	1.81	7,674	15.47	65,593	2/.95271	14.74	62,491
B3	2,080	17.69	36,795	4.89	10,171	12.80	26,624	3/.90844	11.63	24,186
B	9,820	14.70	144,327	2.46	24,145	12.24	120,182		11.54	113,319
C1	485	8.26	4,006	1.96	951	6.30	3,055	2/.95271	6.00	2,910
C2	595	14.10	8,390	1.96	1,166	12.14	7,224	2/.95271	11.57	6,882
C3	340	11.44	3,890	4.79	1,629	6.65	2,261	3/.90844	6.04	2,054
C	1,420	11.47	16,286	2.64	3,746	8.83	12,540		8.34	11,846
D	1,190	2.83	3,368	1.02	1,214	1.81	2,154	2/.95271	1.72	2,052
Total	19,450	14.18	275,895	2.27	44,183	11.91	231,712		11.24	218,665

1/ At 5 percent. Present annual equivalent value per \$1.00 of benefits accruing during a 100-year period.

2/ Assumes a 3-year development period.

3/ Assumes a 5-year development period.

Based upon price projections by the U. S. Department of Agriculture, September 1957.

Prospective Farm Incomes

Estimates of prospective farm incomes have been made for several types and sizes of farms with the proposed project development. Farm incomes are estimated for grade-A dairy, range beef, feeder steer, farm flock of sheep and cash-crop farms. Budgets for each type were developed for evaluation areas A and B. The farm flock of sheep and feeder steer farm types were used in estimating farm incomes for evaluation area C. Grade-A dairy and range beef farm types were used in estimating farm incomes for evaluation area D.

Farm budgets require many kinds of input-output and price information. Labor requirements, machinery and building needs, land investment, feed requirements, and other data are needed. Published research in similar irrigated areas has been heavily relied upon. These data have been supplemented by information collected from project farmers and in nearby areas.

Livestock Enterprises and Production Rates

Sales of livestock and livestock products likely will be the predominant sources of income on the project. Project development probably will not affect any basic change in the livestock economy of the area. It will, however, result in an increase in feed crops and pasture available for livestock. The increased feed supply is likely to result in an increase in the number of dairy cows, farm sheep, and feeder steers.

A production rate of 325 pounds of butterfat per dairy cow is assumed. Feeder steer calves are assumed to gain 390 pounds in 11 months. Sheep are assumed to produce 90 pounds of grass-fat lamb and 10 pounds of wool per ewe. Beef cattle are assumed to produce 783 pounds of grass-fat beef per long yearling.

Types of Farms

Projected types of farms with project development are based upon future market for each agricultural commodity, existing types of farms on the project and available federal grazing permits. Four general farm types were predominant on farms surveyed--grade-A dairy, range beef, general livestock and cash crop. The beef farms were operated in conjunction with federal grazing permits. The dairy farms utilized most of the forage and grain crops produced on the farm. The general farms had a combination of livestock--dairy, beef, and sheep--and utilized most of the forage and grain crops produced. Cash-crop farms produced primarily grain and some alfalfa for sale.

Development of the project is not expected to result in an increase in the number of beef farms with range permits, or the number of livestock in the breeding herds on these farms. A brief description of each projected farm type follows:

Grade-A Dairy - Dairy enterprises consist of 40 cows per farm. Labor requirements are at a maximum for a family-size operation. Seventy percent of the milk produced is sold at a grade-A market milk price and 30 percent is sold at a manufacturing milk price.

Range Beef - Part of the feed supply is furnished by federal range which limits the number of breeding cows to twelve, 97-cow herds or equivalent. The irrigated land serves as a winter feed base for the breeding herd and provides summer pasturage for yearlings. Sale of grass-fat long yearlings is the principal source of income.

Feeder Steer Calves - Steer calves are purchased in the fall from range herds, wintered, and grazed on irrigated pasture the following summer and sold as grass-fat long yearlings in the fall. The size of herd is 150 head.

Farm-Flock Sheep - Farm flocks consist of 450 mature ewes per farm. Sale of grass-fat lambs and wool are the principal sources of income.

Cash-Crop Farms - Alfalfa hay and small grains are produced and sold to dairymen and ranchers on the project and in the surrounding areas.

Capital Requirements

Irrigated farming and development of new farms require considerable capital. Total capital requirements on many farm types expected on the Florida project are shown in table 19. Grade-A dairy farms in evaluation areas A and B require about \$66,000 worth of capital. On feeder steer farms the requirements range from about \$60,000 for evaluation area C to about \$67,000 for evaluation area A. These figures represent cost of new structures and equipment and assume a farm residence valued at \$10,000.

Farms receiving a supplemental water supply with project development possess most of the capital items needed, with the possible exception of additional land development and expansion of livestock numbers. New farms will require most of the capital items listed excluding the present value of cultivated dryland and associated machinery needed for dryland farming.

Return to Operator and Family Labor and Management

An appraisal of the adequacy of projected farm incomes requires a guide or standard in terms of return to operator and family labor and management. An average return of \$3,100 for essentially full-time family-type farms has been considered to be an acceptable minimum level. This amount is used as a general guide in appraising the adequacy of prospective farm incomes. For farms with greater or less than average operator and family labor inputs, capital requirements, or managerial skills, this return would vary accordingly. The farm dwelling and domestic water-supply system are not included as farm expenses or farm receipts in the budget analysis.

Table 19.- Capital investment for illustrative farm types, with project, by evaluation areas, Florida project

Item	Unit	Grade-A : Feeder		Grade-A : Feeder		Feeder	
		dairy	steer	dairy	steer	steer	
Evaluation area		A		B		C	
Total land	Acres	135	170	145	170	170	
Irrigable (project land)	Acres	130	160	140	160	160	
Permanent pasture (non-project land)	Acres	5	10	5	10	10	
Land	Dollars	21,330	26,367	19,583	22,510	21,223	
Farm buildings and improvements ^{1/}	Dollars	9,462	5,775	9,538	5,525	4,775	
Equipment ^{1/}	Dollars	14,065	10,928	14,065	10,928	10,808	
Livestock	Dollars	12,250	13,500	12,250	13,500	13,500	
Total farm	Dollars	57,107	56,570	55,436	52,463	50,306	
Residence ^{2/}	Dollars	10,000	10,000	10,000	10,000	10,000	
Total needs	Dollars	67,107	66,570	65,436	62,463	60,306	

^{1/} Cost of new structures and equipment.

^{2/} Value assumed for purposes of approximating total capital requirements.

Based upon price projections by the U. S. Department of Agriculture, September 1957.

The \$3,100 does not represent the total income received by the farm family from operation of the farm business. In addition to return for labor and management, the farm family will receive a return on its equity in the farm. Return on investment owned by the operator, in addition to returns for labor and management, would be available for family living expenses, including income and social security taxes, savings, and retirement of debt.

Findings

Net incomes for the various sizes and types of farms, from tables 20A, 20B, and 20C are summarized below:

Type of farm	Evaluation areas							
	A		B		C		D	
	Acres	Income	Acres	Income	Acres	Income	Acres	Income
Grade-A dairy	<u>1/</u> 135	\$9,012	<u>1/</u> 145	\$8,494	-----	-----	<u>2/</u> 195	\$7,726
Range beef	<u>3/</u> 170	5,547	<u>3/</u> 170	4,623	-----	-----	<u>4/</u> 225	3,754
Feeder steers	<u>3/</u> 170	5,835	<u>3/</u> 170	4,910	<u>3/</u> 170	\$3,675	-----	-----
Farm-flock sheep	<u>3/</u> 170	5,412	<u>3/</u> 170	4,440	<u>3/</u> 170	3,275	-----	-----
Cash crop	160	4,658	160	3,763	-----	-----	-----	-----

1/ Includes 5 acres of permanent pasture (nonproject lands).

2/ Includes 90 acres of permanent pasture (nonproject lands).

3/ Includes 10 acres of permanent pasture (nonproject lands).

4/ Includes 100 acres of permanent pasture (nonproject lands).

Table 20A.- Projected agricultural incomes and selected sizes and organizational items for farm budgets by types of farms, evaluation area A, Florida project

Item	Unit	Grade-A dairy	Range beef	Feeder steers	Farm- flock sheep	Cash crop
Total land	Acres	135	170	170	170	160
Alfalfa	Acres	54	80	49	50	109
Rotation pasture	Acres	34	29	60	59	-----
Corn silage	Acres	10	13	13	13	-----
Small grains	Acres	25	30	30	30	43
Farmstead, etc.	Acres	7	8	8	8	8
Permanent pasture (nonproject lands)	Acres	5	10	10	10	-----
Productive livestock	Number	40	97	150	450	-----
Operator and family labor	Hours	4,475	3,057	2,320	3,054	1,600
Investment	Dollars	49,298	64,284	51,191	46,502	36,225
Land	Dollars	21,330	27,794	26,367	26,367	26,067
Buildings & improvements	Dollars	5,677	3,465	3,465	3,720	1,932
Machinery	Dollars	8,439	6,557	6,557	6,619	6,106
Livestock	Dollars	12,250	24,575	13,500	8,280	-----
Other	Dollars	1,602	1,893	1,302	1,516	2,120
Farm receipts	Dollars	17,382	14,814	12,954	13,393	10,528
Crop sales	Dollars	759	2,912	2,430	1,310	10,428
Livestock and products	Dollars	16,407	11,802	10,424	11,983	-----
Other	Dollars	216	100	100	100	100
Farm expenses <u>1/</u>	Dollars	5,905	6,053	4,559	5,656	4,059
Farm income <u>2/</u>	Dollars	11,477	8,761	8,395	7,737	6,469
Interest on investment <u>3/</u>	Dollars	2,465	3,214	2,560	2,325	1,811
Adjusted farm income <u>4/</u>	Dollars	9,012	5,547	5,835	5,412	4,658

1/ Does not include interest on capital or annual water costs, including O&M.

2/ Return to operator and family labor and management, capital and irrigation water.

3/ At 5 percent, excluding investment in irrigation water.

4/ Return to operator and family labor and management and irrigation water.

Based upon price projections by the U. S. Department of Agriculture, September 1957.

Table 20B.- Projected agricultural incomes and selected sizes and organizational items for farm budgets by types of farms, evaluation area B, Florida project

Item	: Unit	: Grade-A: dairy	: Range beef	: Feeder steers	: Farm- flock sheep	: Cash crop
Total land	Acres	145	170	170	170	160
Alfalfa	Acres	56	76	42	42	109
Rotation pasture	Acres	38	33	67	67	-----
Corn silage	Acres	11	13	13	13	-----
Small grains	Acres	28	30	30	30	43
Farmstead, etc.	Acres	7	8	8	8	8
Permanent pasture (nonproject lands)	Acres	5	10	10	10	-----
Productive livestock	Number	40	97	150	450	-----
Operator and family labor	Hours	4,500	3,108	2,352	3,102	1,670
Investment	Dollars	47,527	60,425	46,897	42,185	32,106
Land	Dollars	19,583	24,372	22,510	22,510	22,210
Buildings & improvements	Dollars	5,723	3,315	3,315	3,570	1,932
Machinery	Dollars	8,439	6,557	6,557	6,619	6,106
Livestock	Dollars	12,250	24,575	13,500	8,280	-----
Other	Dollars	1,532	1,606	1,015	1,206	1,858
Farm receipts	Dollars	17,098	13,580	12,092	12,904	9,377
Crop sales	Dollars	475	1,678	1,568	821	9,277
Livestock and products	Dollars	16,407	11,802	10,424	11,983	-----
Other	Dollars	216	100	100	100	100
Farm expenses <u>1/</u>	Dollars	6,228	5,936	4,837	6,355	4,009
Farm income <u>2/</u>	Dollars	10,870	7,644	7,255	6,549	5,368
Interest on investment <u>3/</u>	Dollars	2,376	3,021	2,345	2,109	1,605
Adjusted farm income <u>4/</u>	Dollars	8,494	4,623	4,910	4,440	3,763

1/ Does not include interest on capital or annual water costs, including O&M.

2/ Return to operator and family labor and management, capital and irrigation water.

3/ At 5 percent, excluding investment in irrigation water.

4/ Return to operator and family labor and management and irrigation water.

Based upon price projections by the U. S. Department of Agriculture, September 1957.

Table 20C.- Projected agricultural incomes and selected sizes and organizational items for farm budgets by types of farms, evaluation areas C and D, Florida project

Item	Unit	Evaluation area C		Evaluation area D	
		Feeder	Farm-flock	Grade-A	Range
		steers	sheep	dairy	beef
Total land	Acres	170	170	195	225
Alfalfa	Acres	32	33	60	80
Rotation pasture	Acres	77	76	12	5
Corn silage	Acres	-----	-----	8	10
Small grains	Acres	43	43	20	24
Farmstead, etc.	Acres	8	8	5	6
Permanent pasture (nonproject lands)	Acres	10	10	90	100
Productive livestock	Number	150	450	40	97
Operator and family labor	Hours	2,311	3,099	4,500	3,114
Investment	Dollars	44,593	39,881	48,340	60,172
Land	Dollars	21,223	21,223	20,524	24,219
Buildings & improvements	Dollars	2,865	3,120	5,797	3,413
Machinery	Dollars	6,485	6,547	8,439	6,557
Livestock	Dollars	13,500	8,280	12,250	24,575
Other	Dollars	520	711	1,330	1,408
Farm receipts	Dollars	12,539	13,350	16,623	13,078
Crop sales	Dollars	2,015	1,267	-----	1,176
Livestock and products	Dollars	10,424	11,983	16,407	11,802
Other	Dollars	100	100	216	100
Farm expenses <u>1/</u>	Dollars	6,634	8,081	6,480	6,315
Farm income <u>2/</u>	Dollars	5,905	5,269	10,143	6,763
Interest on investment <u>3/</u>	Dollars	2,230	1,994	2,417	3,009
Adjusted farm income <u>4/</u>	Dollars	3,675	3,275	7,726	3,754

1/ Does not include interest on capital or annual water costs, including O&M.

2/ Return to operator and family labor and management, capital and irrigation water.

3/ At 5 percent, excluding investment in irrigation water.

4/ Return to operator and family labor and management and irrigation water.

Based upon price projections by the U. S. Department of Agriculture, September 1957.

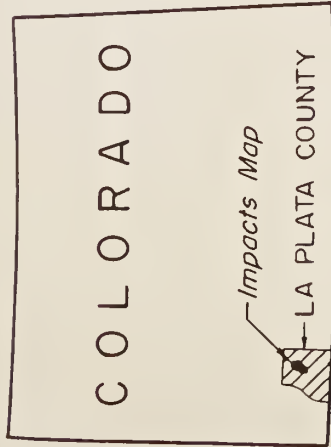
These incomes are available as return to the operator and his family for their management and labor and for payment of irrigation water costs. Many farms will have larger or smaller net incomes than those shown above. The general conclusion from this analysis is that the income prospects for these fully developed farms would be adequate to provide a reasonably satisfactory level of living and make some payments for costs of irrigation water.

Relationship Between Farm-Income and Crop-Production Budgets

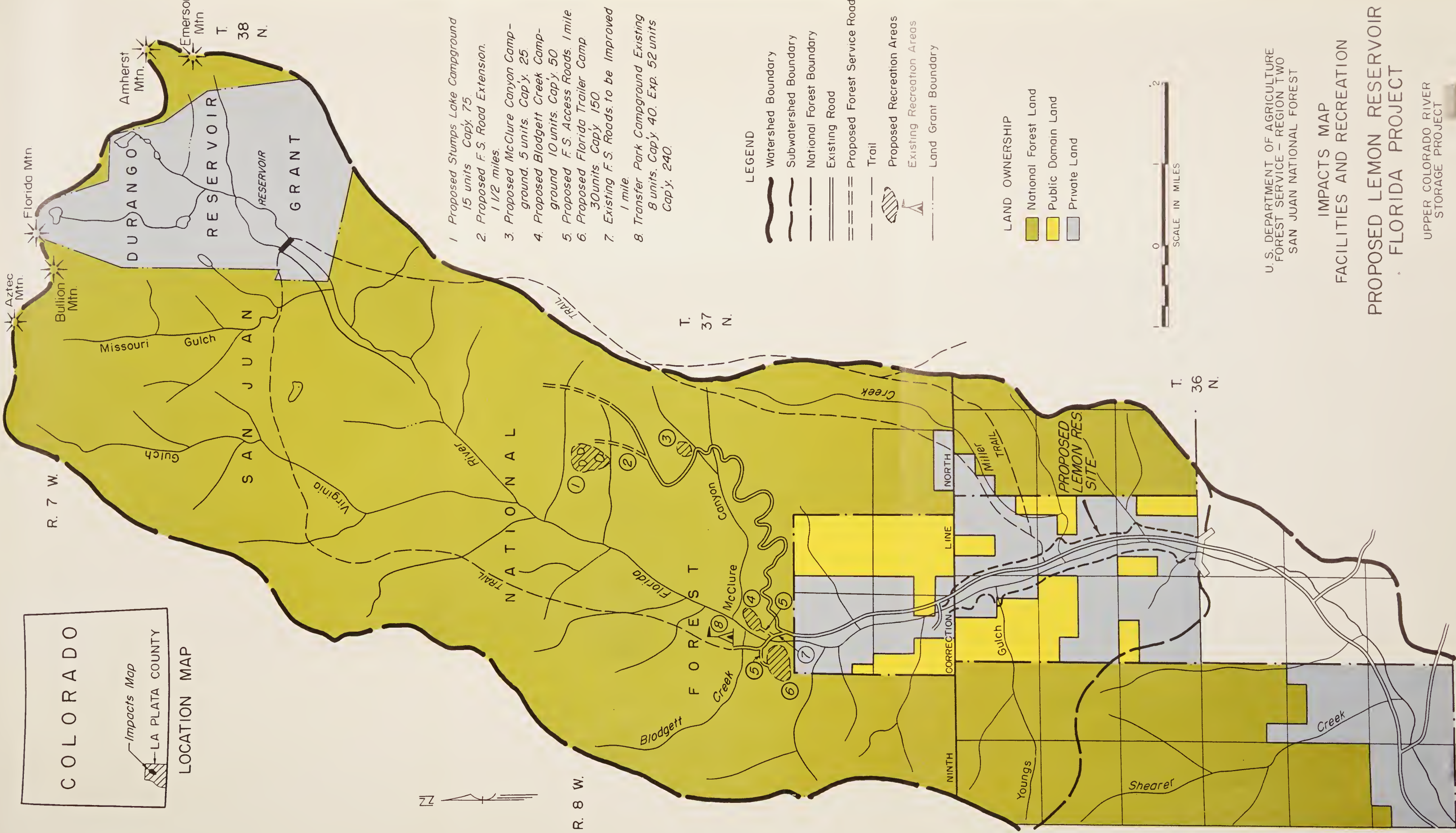
In the two previous sections of this report, two types of budget analyses were used. Farm-income budgets were used in appraising the prospects for a successful, stable agriculture and as a basis for the crop-production budgets used in estimating direct agricultural benefits. Cropping patterns assumed in the benefit analysis are the same as those used in the analysis of prospective farm incomes and thus reflect the need for hay, pasture, and other feed crops in livestock enterprises. In the benefit analysis, forage crops are assumed to be purchased by the livestock enterprises in estimating their influence upon forage prices and cropping patterns.

The estimate of direct agricultural benefits was based on crop-production budgets. The results are shown below by evaluation areas along with benefit estimates based on farm-income budgets. Costs per unit of inputs used in production were the same in the farm-income and crop-production budgets. Distribution of farm types by acreage assumed in both analyses are as follows: Grade-A dairy, 19 percent; range beef, 9 percent; feeder steers, 34 percent; farm flock of sheep, 13 percent; and cash crop, 25 percent for with situation and grade-A dairy, 19 percent; range beef, 12 percent; feeder steers, 32 percent; farm flock of sheep, 12 percent and cash crop, 25 percent for without situation. Estimates of net direct agricultural benefits are \$11.24 per acre for the crop-production budgets and \$12.78 per acre for the farm-income budgets.

<u>Evaluation area</u>	<u>Crop-production budgets</u>	<u>Farm-income budgets</u>
A	\$13.03	\$14.62
B	11.54	13.49
C	8.34	7.96
D	1.72	1.83
Project	11.24	12.78



LOCATION MAP



U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE - REGION TWO
SAN JUAN NATIONAL FOREST

IMPACTS MAP
FACILITIES AND RECREATION

PROPOSED LEMON RESERVOIR
FLORIDA PROJECT

UPPER COLORADO RIVER
STORAGE PROJECT

CHAPTER III

RELATIONSHIP OF THE FLORIDA PARTICIPATING PROJECT TO THE MANAGEMENT, PROTECTION, AND USE OF THE SAN JUAN NATIONAL FOREST AND OTHER FOREST RESOURCES

Introduction

This section of the report considers the impact of the Florida participating project on the San Juan National Forest and on other forest and rangelands. It is aimed at determining what facilities, resources, and uses will be affected and at evaluating these effects.

Area Concerned

The proposed project features, including Lemon Dam and Reservoir and the Florida Ditches, are entirely outside the exterior boundary of the San Juan National Forest. The proposed reservoir is at a distance of one-quarter to two miles from the national forest boundary; the Florida Ditches are well below the boundary.

While there are about 204 square miles in the total watershed of the project, impacts of project construction and operation upon national forest lands and forest and rangelands of other ownerships will be confined to the Florida River drainage lying above the dam site. This part of the project area contains about 73 square miles of which 79 percent is national forest lands, 6 percent is public domain, and 15 percent is privately owned. (See map attached.)

Present Status and Current Use

Existing Facilities

Existing Forest Service facilities within the project watershed include 9.3 miles of forest development road, 1 bridge, 30 miles of trail, and 1 developed recreation area. In addition to the forest development road, there are about 15 miles of timber harvesting roads on national forest lands constructed by timber sale operators. None of these improvements will be flooded.

Current Management

National forest lands involved within the watershed are under administrative management and protection which is compatible with the proposed project.

Current Use

Primary forest land resources within the project watershed are: Timber, forage, water production, recreation, and wildlife habitat.

Annual timber cut from national forest lands averages approximately 5,000,000 board feet with a minimum stumpage value of \$40,000 per year.

On the national forest, 7 permittees graze 185 cattle and horses and 4,288 sheep for a total of 3,115 animal-unit months. Receipts from this use amounted to \$1,783 in 1959.

Recreation use on the watershed is moderate; it is estimated the use for hunting, fishing, camping, picnicking, and sightseeing has risen to 8,000 man-days annually.

There is very little mining activity, including oil and gas leasing within the area. There are some mining claims, but little or no development work has been done. These developments will not be affected by project construction and operation.

At present, the Forest Service has one area of national forest land withdrawn for a recreation site within the watershed. No Forest Service rights-of-way are involved. The Bureau of Reclamation has not withdrawn any national forest lands for this project.

The city of Durango has an Executive Grant to 3,049 acres at the head of the Florida River drainage for watershed and reservoir purposes which is part of the city of Durango's water system.

Estimated Future Status Without Project Developments

Timber harvest will continue to increase at a moderate rate on national forest as well as lands of other ownerships.

Adjustments in grazing use on the national forest will be continued to bring stocking and actual use into agreement with carrying capacities and proper use of the range. This action will provide better protection of the project watershed.

The trend of increasing recreation use will continue. An estimate of 50 percent increase in the next five years is conservative. The Forest Service already plans additional facilities for this recreation use. Transfer Park Campground is being expanded and two additional sites are to be developed to provide recreation facilities for 55 family units and capacity of 275 people.

The forest and rangelands in other federal and private ownerships will continue to be used for grazing, forestry, wildlife, and recreation purposes.

Impacts of Project Construction and Operation on the National Forest (Estimated Future Use With Project Development)

Construction of the Lemon Dam and Reservoir will have significant effects upon national forest responsibilities and activities, both during the construction period and after the project is in operation.

Impacts on General Administration

The organization and objectives for administration and management of the national forest lands will not be changed.

No Forest Service improvements will be adversely affected by project development.

Relocation of the county road in the vicinity of the dam and reservoir site will be necessary. While this is outside of the national forest boundary, this road serves a portion of the national forest area in the Florida River drainage. The Bureau of Reclamation is providing for necessary relocation in the project planning and construction.

The proposed reservoir will attract many visitirs for camping, picnicking, boating, and fishing. This increased recreational use will also extend to adjacent national forest lands. This project-created increase on the national forest is expected to amount to at least 24,000 visitor-days annually. The need for administrative and fire protection services on the national forest will be increased.

Progress in current range improvement and management programs on the national forest should be stepped-up so that rehabilitation and management features, directed at improving watershed conditions, can be completed by the time the project is put into operation. Watershed conditions on privately-owned lands could be improved in similar manner.

Impacts on Protection

Forest fires that might originate in connection with project construction will pose a threat to national forest lands and may require Forest Service action to suppress. Intensified fire protection will need to be provided during project installation. After construction, the chances of fire occurrence will be intensified because of increased recreational use of the area. Fire prevention services will need to be increased above present level of protection to meet this risk.

Impacts on Forest Resource Volumes and Values

There will be no appreciable change in timber production or harvesting costs on either national forest or privately-owned lands.

Impacts on Resource Use and Development

The proposed Lemon Dam will lie in the Florida River Canyon just outside of the national forest boundary. The reservoir will be flanked on three sides at a distance of one-quarter to two miles by the national firest boundary; the site being within an exclosure five miles long and two miles wide. (See map attached.) Of the ten sections of land involved in this exclosure almost 40 percent is now in public ownership under Bureau of Land Management jurisdiction. Aside from the open land in private ownership in the canyon bottom, the entire area is covered with timber and brush. Steep mountain slopes rise directly up to the national forest boundary. These slopes support a vegetative cover of fir, spruce, aspen, and oak brush which extends onto the adjoining national forest lands. Fires that might originate at the reservoir, or on adjacent areas used for recreation, will pose a threat to national forest lands and may require Forest Service action to suppress. This location of the reservoir gives the Forest Service justifiable concern and interest regarding the character of use and development that will take place around the reservoir and on the intervening lands.

It is anticipated that the proposed reservoir will attract many visitors for camping, picnicking, boating, and fishing. Some of this increased recreational use will also extend to the adjacent national forest lands. Providing protection from fire to adjoining national forest, other federal, and privately-owned forest lands; safeguarding the health and safety of the public users; and insurance against pollution of project water supply, should be adequately included in plans for project construction and operation.

The lands adjacent to the reservoir should be reserved or acquired, retained in public ownership, and administered by a public agency to insure and protect the public interests and to provide for adequate public access to the reservoir. This will also provide areas for recreational use on which campgrounds, picnic grounds, observation points, parking areas, etc., should be developed, thereby reducing additional impacts on present national forest lands which are not as suitable and which would be more costly to develop for recreational use. It would insure that the shoreline would be accessible to the public. It would provide needed control of the type of developments and use to insure prevention of fire and protection of public health and safety. The concerned federal and state agencies may wish to consider a proposal to extend the present national forest boundary to accomplish these objectives. Withdrawal of all federal lands in the above-described ten square mile block and their retention in unencumbered condition until future needs for these lands for public recreation or other purposes can be determined, is desirable.

Appraisal of Project Impacts

This appraisal is based upon limited factual information. Estimates are based on 1959 data and figures. Impacts and estimates may require changing as detailed information becomes available from project planning now in process.

Construction of the project will not require relocation and restoration of any Forest Service facilities. The cost of intensified fire protection during the construction period should be included as a part of project costs, to be financed by the construction agency. Project construction contracts should contain appropriate fire liability clauses and contractors should be required to furnish bonds covering losses and suppression costs of forest fires originating in connection with project construction. Estimates of these costs are shown in table 21.

Past experience with similar projects such as the Bureau of Reclamation's Vallecito Reservoir, which is located on the Los Pinos River approximately six miles east of the Lemon Site and is within the boundary of the San Juan National Forest, indicates there will be a large increase in recreation use during and after project construction. It is anticipated that the Bureau of Reclamation and the National Park Service will consider the needs for recreational improvements on lands outside the national forest boundary. This increased use will also extend onto adjoining and nearby national forest lands. Additional facilities will be needed to safeguard public health and safety, prevent the pollution of water supply, and to protect public property. This will require development of recreation sites, water and sanitary facilities, and other facilities on the national forest lands. Estimates are shown in table 22. These costs are to be financed by the Forest Service from its regular appropriations.

To adequately redeem its public responsibilities, it is essential that the Forest Service maintain the improvements constructed on national forest lands to meet project-imposed needs and that it provide administrative services to manage these developments. Estimates for these services are shown in table 23. Funds to cover such costs will be requested by the Forest Service in its regular budget procedure.

The effects of project construction and operation upon forest resources of nonfederal forest lands will be negligible. After project construction, increased public use of the area will require intensification of present federal-state cooperative fire prevention services on the nonfederal forest and rangelands in the project area.

This appraisal does not include estimates of anticipated increased recreational use and facilities needed for this use on the area outside the forest boundary. The Forest Service will work with the National Park Service in making estimates of future use and recreation plans for this area.

Forest Service appraisal of recreation impacts of the proposed Florida project, have been discussed with representatives of the regional office of the National Park Service at Santa Fe, New Mexico. A reviewed draft of the appraisal of future recreation uses, needed development, and plans for meeting these needs on national forest lands was referred to that office for comments. In their reply, the National Park Service offered no objections to or suggestions for changing Forest Service estimates and proposed plans for meeting the anticipated recreation use on national forest lands.

Table 21.- Project-imposed direct costs to existing improvements and services on the San Juan National Forest, Florida project 1/

Kinds of services or facilities	Quantity	Estimated cost
		Dollars
Relocation and restoration of Forest Service improvements	0	0
Increased maintenance costs during construction period	0	0
Intensified fire protection during construction period	-	1,800
Subtotal		1,800
Contingency allowance, 10 percent		200
Total		2,000
Amortization, 50-year period at 2.5 percent		70

1/ To be financed by construction agency as part of project construction.

Table 22.- Nonreimbursable, project-imposed direct costs to national forest lands or services, Florida project 1/

Kinds of services or facilities	Quantity	Estimated cost <u>Dollars</u>
New facilities required to serve project-created uses <u>2/</u>		
Campgrounds, picnic sites, and associated facilities, 65 family units	5 sites	63,400
Additional administrative services required during construction period	-----	<u>1,600</u>
Subtotal		<u>65,000</u>
Contingency allowance, 10 percent		<u>6,500</u>
Total		<u>71,500</u>
Amortization, 50-year period at 2.5 percent		2,521

1/ To be financed by Forest Service from its regular appropriations.

2/ On national forest lands.

Table 23.- Nonreimbursable associated, project-imposed costs or values to national forest resources or services, Florida project 1/

Item	Average annual cost or value <u>Dollars</u>
Increased management costs	
Personnel services for increased fire protection and administration	550
Maintenance and management of recreation facilities	<u>4,750</u>
Total average annual cost	<u>5,300</u>
Resource values lost	Neeligible
Benefits	
Recreational use, 24,000 man-day visits annually	<u>2/</u>

1/ To be financed by the Forest Service from its regular appropriation.

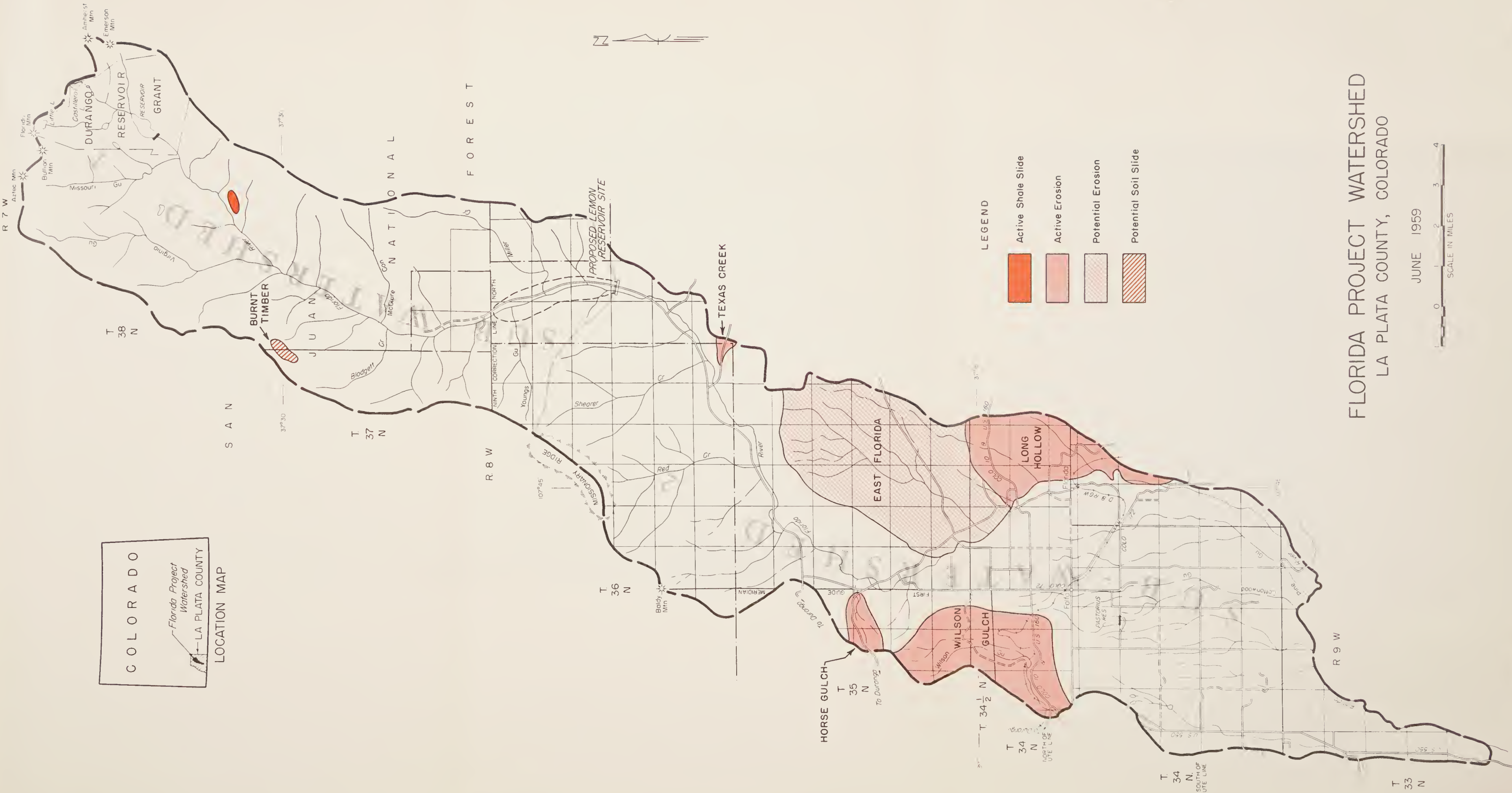
2/ Gain of 24,000 visitor-days annually; value not determined.

Findings

The proposed Florida project is adjacent to the San Juan National Forest. The Lemon Reservoir site lies within an enclosure five miles long and two miles wide, bounded on three sides by forest lands. (See map attached.) The proximity of the reservoir gives the Forest Service justifiable concern and interest regarding the character of use and development that will take

place around the reservoir and on the lands extending to the national forest boundary. The manner in which these lands are owned and administered will also bear an important relationship to future use, protection, and management of the national forest. Construction and operation of project installations will have significant effect upon national forest administration, management and protection. Therefore, the following are recommended:

1. That the Department of the Interior withdraw all the federal lands within the ten square mile block described above and retain them in unencumbered condition until future need for these lands for public recreation or other public purposes can be determined.
2. That lands adjacent to the reservoir be reserved or acquired, and that they be retained in public ownership and administered by a public agency or agencies to assure and protect the public interests and to provide for adequate public access to the reservoir. The concerned federal and state agencies may wish to consider a proposal to extend the national forest boundary to accomplish these objectives.
3. That the Bureau of Reclamation and the National Park Service will consider the needs for recreational improvements on these lands outside the national forest boundary.
4. That recreational facilities, such as public campgrounds, picnic grounds, and other recreational sites, should be planned and developed at the reservoir and on adjacent areas to serve the people who will be attracted to the area. Such facilities and developments should be limited to those necessary for adequate protection of public health and safety, to prevent pollution of water supplies, and to safeguard public property including national forest and other resource values. Provisions for planning, development, and construction of such facilities should be made an integral part of project plans and appropriations.
5. In financing project construction, the cost of providing intensified fire protection during the construction period should be included as part of project costs to be financed by the construction agency.
6. To insure and protect the United States from damages of forest fires on national forest lands, construction contracts should contain an appropriate fire liability clause, and the construction agency should require contractors to furnish bonds covering losses and suppression costs of forest fires caused by the contractors or their employees in the course of project installation.
7. That the Bureau of Reclamation and the Forest Service cooperate fully in surveys, development of plans, and schedules of planning and construction in all phases of the project having effect on administration and protection of national forest lands.
8. That provision be made to re-examine this appraisal of impacts in the event that features of the proposed reservoir system are changed substantially in connection with the preparation of project plan reports by the Bureau of Reclamation.



FLORIDA PROJECT WATERSHED
LA PLATA COUNTY, COLORADO

JUNE 1959

SCALE IN MILES

CHAPTER IV

RELATIONSHIP OF WATERSHED CONDITIONS TO THE FLORIDA PROJECT

Watershed conditions covered in this report do not materially affect feasibility of the project. However, the alleviation of local problems and improvement of watershed conditions will extend the life of the project and reduce operating difficulties and maintenance expenses.

These conditions and problems are pointed out here so local, state and federal agencies which deal with this watershed can orient their regular and special programs to the eventual solution of these problems.

Location and Size

The watershed affecting the Florida project is located east of Durango, Colorado. The watershed begins on the south slopes of Aztec, Florida and Emerson Mountains and follows the Florida River, in a southwesterly direction, to its junction with the Animas River at Bondad, Colorado. The watershed area is approximately 5 miles wide and 40 miles long. All of Florida Mesa is included in the watershed because it contains the majority of the project lands even though some of the drainage is divided between the Animas River and the Florida River.

For this report, the watershed is subdivided into two subwatersheds as shown on the watershed map and in table 24.

Table 24. - Subwatersheds, Florida project

Number	Description	Square miles
1	Above proposed Lemon Reservoir	73
2	Florida Mesa and other lands below proposed Lemon Reservoir	<u>131</u>
	Total	204

Watershed Characteristics

Topography and Geology

The topography of the watershed ranges from gently sloping to rolling mesas and benches at the south end, to very rough, steep, high mountainous lands in the headwaters. Igneous and metamorphic rocks compose the upper reaches of the watershed, while the lower part consists mainly of sedimentary formations with scattered metamorphic inclusions.

Subwatershed No. 1

The elevations of this subwatershed range from 8,000 to 13,147 feet above sea level. This higher country is composed of very steep, narrow, glaciated canyons and rough, broken, rocky ridges. The main valley from the Lemon Dam site to Transfer Park is of glacial origin with steep sides and relatively flat valley floors.

Subwatershed No. 2

The mesa and bench area sheds water into two principal drainageways. The southwestern part of the subwatershed drains into the Animas River through Wilson Gulch and several small drainageways. The north and southeastern part of the subwatershed drains into the Florida River through many small to medium sized drainageways including Cottonwood Gulch, Pine Gulch and Long Hollow.

The southern portion of the subwatershed is a loess-covered drift plain with a well defined drainage pattern. The larger drainages have small valleys eroded into the underlying Animas formation.

Shale benches and hills with steeply rolling topography are located in the north and east portion of the subwatershed. Along the northern part are steep foothills composed of sandstone ridges separated by fairly deep valleys cut into Cretaceous shale. The south faces of these ridges are steep, rocky soils underlain by sandstone, while the north slopes have very steep to precipitous shale exposures.

Precipitation and Runoff

The average annual precipitation over this watershed is extremely variable. In the lower reaches of the valley, precipitation averages 13 inches per year while in the high mountain area it averages about 45 inches per year.

Generally June is the driest month. High intensity rainstorms occur in July, August, September and occasionally in October.

Flood water runoff can be expected in May and June from snow melt and during July, August, September or October from high-intensity rains.

Vegetative Cover

The vegetative cover for the watershed, by principal type and condition, is shown in table 25.

Table 25. - Vegetative types, watershed area, Florida project

Principal vegetative type	Percent of area	Watershed cover conditions			
		Good	Fair	Poor	Total
<hr/>					
		<hr/> Square miles <hr/>			
Dense conifer timber	27	55	--	--	55
Open conifer timber	20	21	10	10	41
Aspen	6	11	1	--	12
Oak brush	9	--	6	13	19
Sagebrush	4	--	--	7	7
Grass	7	9	3	3	15
Pinon-juniper	5	--	2	8	10
<hr/>					
Subtotal	78	96	22	41	159
Barren	7	--	--	--	15
Cultivated land	15	--	--	--	30
<hr/>					
Total	100	96	22	41	204

Soils and Erosion

Subwatershed No. 1

The terrain in subwatershed No. 1 is characterized by steep slopes with varying depths of soil.

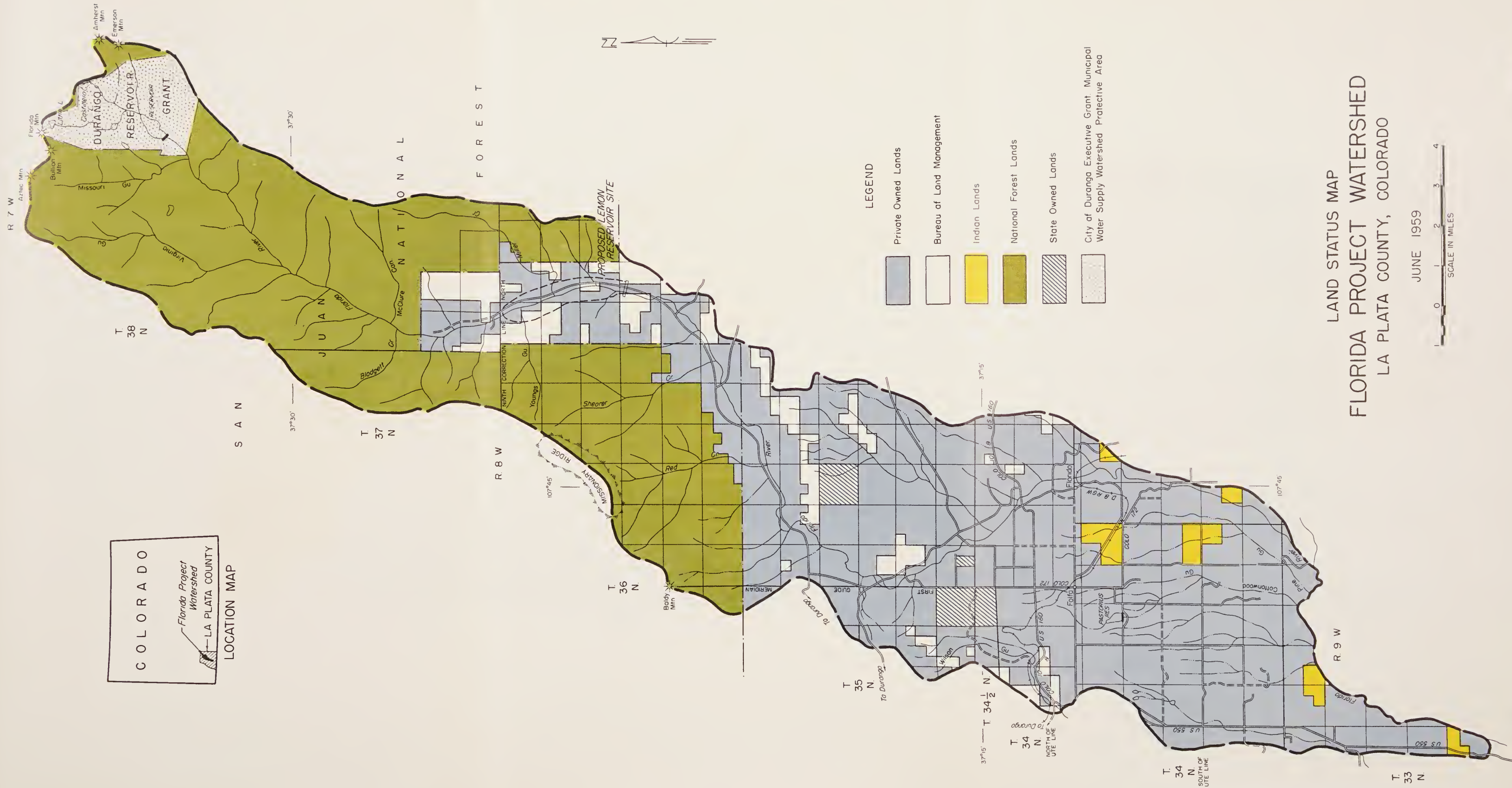
There are two small critical areas (see map) in this subwatershed where erosion might increase unless good management practices are maintained. These critical areas are a soil slide on Burnt Timber Creek on the west and an active shale slide across from Coulter Mesa on the east side. Generally speaking, there is adequate vegetative cover on the subwatershed to restrict soil movement to a nominal amount for this type of watershed.

Subwatershed No. 2

Subwatershed No. 2 is characterized by moderate to fairly steep undulating slopes and narrow to wide swale drainageways. The soil mantle is moderately deep to very deep.

Severe gully and sheet erosion occurs on approximately 15 square miles of this subwatershed. The critical areas shown on the watershed map include the drainage areas of Wilson Gulch, Long Hollow, Texas Creek and Horse Gulch.

The area has mixed shrub-type vegetation with good density. This cover does not afford protection against erosion because it lacks litter and residue. Most of the erosion is caused by overuse of the vegetative cover by grazing



animals. A severe erosion condition exists in the Horse Gulch area due to its continuous use as a stock driveway. There are a few areas of ashy soils that are naturally susceptible to both wind and water erosion.

The potential critical area of east Florida River is shown on the watershed map. This area will erode seriously unless effective control practices are installed soon.

Land Use

Subwatershed No. 1

Approximately 85 percent of the subwatershed is federal land. The Bureau of Land Management administers approximately 4 square miles and the Forest Service about 58 square miles. This land all has a multiple use which includes timber production, grazing of cattle and sheep, wildlife and recreation. The remaining 11 square miles of the watershed are privately owned and are used primarily for grazing purposes. There is some timber cutting and recreational use made of the privately owned areas, as well as a few small cultivated fields.

Subwatershed No. 2

This subwatershed is predominately privately owned and operated land with a small amount of federal-owned land administered by Bureau of Land Management, Forest Service and Indian Service.

Approximately one-third of the area is cultivated and the remaining two-thirds is used for grazing, watershed and recreation. The cultivated lands are used for the production of feed grains and forage.

The vegetative cover types on the rangelands vary from sagebrush and pinon-juniper on the south, to ponderosa pine on the north.

Land Ownership

The land ownership is shown in table 26. All private land is essentially owner-operated. The national forest and public domain lands are generally used by farmers and ranchers living within the watershed.

Table 26. - Land ownership, Florida project watershed

Class of ownership	Square miles
Private	106
Indian Tribal Land	3
Public Domain	9
State Lands	3
National Forest Land	80
City of Durango	5
Total	<u>204</u>

Watershed Problems

Subwatershed No. 1

This subwatershed consists of the Florida River drainage above the proposed Lemon Reservoir site. The lands involved generally have a good vegetative cover. The major plant cover types are aspen, spruce-fir and grass. Soil loss from this area is normally slight. If the present vegetative cover condition is maintained or improved, little if any damage is anticipated.

There are two critical areas within this subwatershed that are located on the watershed map.

1. Shale slide area on east side
2. Soil slide area on Burnt Timber Creek

Subwatershed No. 2

This subwatershed comprises the area below the proposed Lemon Reservoir. A large majority of this subwatershed area is the Florida Mesa area. The ridge between the Florida and Animas drainages divides the mesa.

Overflow of project lands is a minor problem because the majority of the project lands are on Florida Mesa. This mesa is not only the top of the drainage but has numerous waterways that will dispose of flood and waste irrigation water safely. Project lands located along the Florida River will be protected from river overflow by the stream regulation from operation of the proposed Lemon Reservoir.

Project facilities are in danger of flooding and sedimentation from side drainages tributary to the Florida River. These flood and sediment source areas are shown on the watershed map and are between Florida Mesa and the proposed Lemon Reservoir. Supply canals will be designed with maximum protection where they cross large drainages. Flood damages and sedimentation from numerous small drainages must be corrected by watershed management and regular operation and maintenance activity. The main supply canals for the project cross Wilson and Horse Gulch which are two very active eroding areas. The active erosion in the Long Hollow drainage, and potential erosion in east Florida drainage, will endanger some supply canals and project lands on the east side of the Florida River.

Summary of Watershed Problems

Watershed problems for the two subwatersheds are summarized as follows:

1. Flood damage and sediment accumulation from periodic high-intensity summer rainstorms or flash floods.
2. Runoff and sediment yield from range in poor condition due to low density and vigor of forage plants caused by overuse by grazing animals.

3. Sediment yield from shale and soil slides carried to the reservoir.

4. Heavy silt deposition in main irrigation canals and distribution ditches from flash floods resulting in excessive maintenance cost.

Recommended land treatment measures that will help to solve the above-listed watershed problems are listed in table 27.

Land Treatment

Table 27. - Recommended land treatment, Florida project watershed 1/

Treatment	Unit	Estimated amount		
		Private land	Federal land	
			B.L.M.	F.S.
Proper use of range forage	Acre	40,440	5,600	52,400
Stockwater development	Number	200	12	-----
Water spreading and gully control	Acre	10,000	1,500	-----
Fences for grazing distribution	Mile	50	3	-----
Brush and weed control	Acre	10,000	480	-----
Establishment and improvement of irrigated pasture	Acre	7,000	-----	-----
Range reseeding	Acre	9,000	480	-----
Reforestation	Acre	-----	-----	2,000
Woodland management	Acre	7,000	-----	-----
Reorganization of ditches	Mile	55	-----	-----
Farm fish ponds	Each	10	-----	-----
Trail construction and maintenance	Mile	-----	-----	30
Land leveling and grading	Acre	1,900	-----	-----

1/ Excluding project lands

Federal Lands

National Forest Lands

A range improvement and management program is being carried out on the national forest lands as rapidly as available funds and time permit. It is felt that this program will adequately meet the watershed protection needs on these lands. The planned program includes: (1) Completion of range analysis studies; (2) completion of range management action plans; (3) initiation of indicated adjustment in range use; (4) encouragement of permittees and other ranchers to use the best range management practices; and (5) completion of work on developing accurate planimetric base maps.

Timber cutting is now in progress and will continue. Supervision is given to logging methods and extreme care is given to proper road location to control erosion. Reforestation plantings will be made on cutover and burn areas.

Public Domain - Bureau of Land Management

The public domain lands, managed by the Bureau of Land Management within the watershed area, consist of scattered and isolated tracts. These tracts are primarily managed from the standpoint of timber and grazing resources. Currently, small timber sales are being made on some of the tracts. In 1958 the Bureau reappraised the grazing allotments and made adjustments to bring the use in line with range analysis studies. Soil and moisture improvement practices and treatment are planned and scheduled for application in accordance with the twenty-year plan. Wildlife, recreation and watershed are important multiple use considerations in the management of these lands.

Private Lands

The primary objective on these lands is to improve the vegetative cover and soil condition.

Practices needed to accomplish this include: (1) The proper use of range-lands. (Adjustment of livestock numbers and methods of grazing will be made to improve vegetative cover, control erosion and reduce sediment production.) (2) Practices to supplement proper use such as reseeding grasses, fencing for better distribution, water development and gully stabilization.

Practices for cropland are: Management practices that will improve water intake of soils; improved application of irrigation water; land leveling; improvement of ditch systems and installation of irrigation structures; and improvement of other farm management practices such as better crop varieties, improved crop rotations, irrigated pasture management, and increased use of fertilizer.

These lands are located within the boundaries of the La Plata Soil Conservation District, and at present about 65 landowners are cooperators of this district.

Indian Tribal Lands

Approximately three square miles of Indian Tribal lands are intermingled with the privately-owned lands. The use and treatment on these lands will be similar to that on private lands.

State Lands

About three square miles of state-owned land is intermingled with the privately-owned lands. The use and treatment on these lands will be similar to that on privately-owned lands.

Flood Prevention Structures

The design of the Lemon Reservoir will provide a storage area for sediment. Improved management and use of watershed lands, plus related measures such as fencing, revegetation and small structures, will minimize the need for major flood control structures. Consequently, no large flood control structures are recommended.

Irrigation Aspects

There are two major irrigation systems and a number of small individual ditches that distribute water to the cultivated lands in the project area.

The proposed Lemon Reservoir will materially assist in regulating the streamflow and lessen the danger of damage to the small ditch headings downstream. Project canal designs include structural measures and channelization, as required where major drainages intersect canal systems. Small areas of local runoff, due to heavy rains, can be handled by regular ditch operation and maintenance.

Improvement of watershed conditions will reduce ditch operation and maintenance cost.

Findings

The watershed condition above the Lemon Reservoir site does not pose a serious flood hazard to the project. The design of the reservoir structure will provide for water storage and sediment deposition.

Drainages below the Lemon Reservoir site will present sedimentation problems from small local drainageways to the irrigation delivery systems. Sediment yield can be reduced by proper land treatment.

Watershed treatment can be accomplished under the regular programs of federal land administering agencies and private landowners, with the assistance normally furnished by federal and state agencies. The users of these watershed lands will receive sufficient benefits to justify their full cooperation in this effort.

CHAPTER V

REGULAR ACTIVITIES OF THE U. S. DEPARTMENT OF AGRICULTURE PARTICULARLY AFFECTED BY THE FLORIDA PROJECT

Introduction

The U. S. Department of Agriculture and the Colorado State University are presently carrying out a number of agricultural activities in La Plata County, Colorado. This is being done under regularly established programs. With the increased agricultural activity that would accompany the proposed development of the Florida project, these programs would need to be accelerated.

Assistance furnished by these programs will materially aid and accelerate the settlement of project lands.

Agricultural Extension Education and Information

The Colorado Cooperative Extension Service maintains an office at Durango. The services of a resident Extension Agent, Assistant Extension Agent, Home Demonstration Agent, and the nonresident specialist located on the campus at Fort Collins, are available to farmers in the project area.

With the development of the project, additional information and educational services will be required. This is particularly true in connection with any expansion in the dairy and livestock industry. Some additional information and education in connection with better irrigation water management and pasture development, will also be needed.

Technical Assistance

The Florida project lies within the boundaries of the La Plata Soil Conservation District. The Soil Conservation Service maintains a work unit office at Durango, Colorado, staffed by a unit conservationist, resident engineer, soil scientist and conservation aid. Other specialized assistance is available through the Soil Conservation Service area office at Monte Vista, Colorado, including administrative assistance and specialist help in engineering, soils, agronomy, woodland and range. Additional technical services from Soil Conservation Service technicians will be required in connection with planning and application of conservation practices including land leveling, improvement of farm irrigation systems, improved water management and soil fertility management.

Farm Financing

With the completion of the Florida project, it is anticipated that the demand for Farmers Home Administration services will be increased. This demand will largely be for loans of the Soil and Water Conservation and operating type. Some farm-housing type loans, however, will probably also be requested.

Loans will be used for the establishment of conservation measures such as the enlargement and repair of canal and ditch systems, construction of new ditches, land clearing, land leveling and other related practices. Since many of the dryland and semi-irrigated farms in the project area are quite large, it is possible that the land may be subdivided and some new farm units established. This will require the construction of farm dwellings, buildings and other facilities.

The above-mentioned farm improvement measures and farm adjustments will, in many cases, require long-term credit that cannot be supplied by local commercial credit sources. Farmers Home Administration credit programs will be called upon to provide needed assistance.

Cost-Sharing for Conservation Measures

The construction of the Lemon Dam and Reservoir, together with other proposed developments, will be a boon to the farming economy of La Plata County. It is expected that these improvements will encourage the landholders to carry out needed farm irrigation system reorganization in order to obtain maximum benefits of the improved water supply. To assist farmers in attaining their objectives in soil and water conservation, the La Plata County Agricultural Stabilization and Conservation Committee, will share the cost of installation of necessary farm conservation measures, under the Agricultural Conservation Program. Increased activity is anticipated in such practices as irrigation ditch development, land leveling and irrigation structures.

Future farming operations will be more profitable than in the past, and such gains will be reflected in increased urban prosperity.

National Forest Land

The proposed project features and project lands are all outside the exterior boundary of the San Juan National Forest. The proposed Lemon Reservoir will attract visitors to the area, and many of these will seek recreational opportunities on adjacent national forest lands during and after project construction.

Additional administrative personnel and other services will be required to provide adequate fire prevention and to manage and service recreational use and facilities.

Restoration, proper management of timber and plant cover, and stabilization of the soil mantle are prime objectives of the San Juan National Forest. Programs aimed at these objectives are now being carried out and have achieved good results. Construction of the project will add further impetus to early accomplishment of the range improvement, range management, and timber harvesting aspects of these programs. These activities will aid the general watershed protection objective of reducing floodwater and sediment hazards to project installations and their maintenance.

Research Needs

A comprehensive report covering general research needs for the area of the Colorado River Storage Project will be developed by representatives of the U.S. Department of Agriculture research agencies, state agricultural colleges, and experiment stations. As far as the Florida project is concerned, there appear to be no research needs peculiar to this project that would not be covered in the above-mentioned report.

